

LUTHER BURBANK
PLANT MAGICIAN

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by

JOHN Y BEATY

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DEDICATED TO

MY MOTHER,

MRS. D G BEATY

Who first taught me to enjoy this beautiful world which Luther Burbank made still more fascinating

CONTENTS

THE LUTHER BURBANK I KNEW

We call Luther Burbank a plant magician because he performed feats with plants which were as startling as the illusions of the stage magician

He made a red flower from a yellow one

He made the stones of plums disappear

He caused the desert cactus to grow a thousand times faster than it had ever grown before.

He made a blackberry white

He made 500 kinds of berries grow on one tree.

Luther Burbank was the first man to devote his entire time to creating new plants; and he succeeded in producing more useful new varieties of fruits, flowers trees vegetables, and vines than any other person. H demonstrated Nature s ability to provide mankind with new foods in almost endless variety and he d veloped a method fo helping Nature to create new plants more quickly

He recognized time as a gift of the Creator which is to be used to the fullest extent, and he lived a happy life of seventy-seven years because he continually tried to be useful. His experience illustrates a way of working to make a dream come true which can be followed by any boy or girl with a goal in mind.

The boys and girls in Santa Rosa, California where Luther Burbank lived knew him as a friend Hello, Mr Burbank, they would shout as they passed his garden. No matter how busy he was he would stop wave his hand and call back.

I worked with Mr Bu bank in the prepar books in which he told th story of his man experiments. My office was in his old home, spent at least an hour each day listening to manuscript I had written At other ti with him through his garden or w

through his orchard. He would pick a plum, taste it, and if it pleased him he would pick another one like it and hand it to me He would tell me what he liked about the plum—or what was wrong

One day I was walking with him through an acre of gladioli. Each plant in that acre was a new variety and he was selecting those to be retained for future work. I always walked behind him, and did not speak to him, until he stopped to rest and offered to talk.

On this day he suddenly whirled around and with his extreme frankness said Say I like you. You know enough to keep your mouth shut. Most people who come with me into my garden jabber jabber all the time, and don t give me a chance to think. This is hard work I am doing I am trying to decide whether to keep each flowe or destroy it And I can t be bothered with people asking me questions until I stop to rest.

Because of the unpredictable things which Mr urbank accomplished, the newspapers of the country equently published fantastic stories about his work. One story was that he had crossed the bee and the lightning bug so that the bee could work twenty four hours a day! Another was that he had crossed the milk weed and the pumpkin vine so that pumpkin pies were produced in the garden.

As a result of this publicity he was sometimes irrita ted by the large numbers of visitors who came to see him from all parts of the U ited States, and other parts of the world. Some people came entirely out of curiosity for his fame had travelled far and wide Some liked to return home after a trip to say "I saw the Great Burbank. If these people had nothing important to say to him and if they had no intelligent questions to ask, he felt that talking with them was a serious loss of time.

After having been irritated by such visitors he sometimes said Those people come here to look at me

like an animal in a cage. I can t waste my time with them My time is worth a hundred dollars a minute.

This does not mean that he was not friendly or that he was discourteous *He sometimes spent two hours* with one person—$12 000 worth of tim at his own estimated value—simply because that person asked intel ligent questions and proved to be an intelligent listener

While there were times when certain work had to be attended to without delay it was seldom that Mr Burbank was too busy to see a visitor who was genuinely interested in plant development. He was always willing to share his knowledge and experience, all during his life Mr Burbank encouraged scientists, nurserymen seedsmen, and agricultural authorities to visit his grounds and comment on what they saw He was always free to tell what his objective was and always free to explain how the progress observed had been obtained. He had no secrets. H enjoyed talking with anyone who understood his work.

On one occasion he had the pleasure of entertaining Thomas Edison and Henry Ford at the same tim The three men were very much alike in that they all had the ambition to serve mankind. And they all realized that the way to do it was to study earnestly plan systematically and give the utmost attention to details

They enjoyed each other s company because of the similarity in their natures. Mr Edison considered M Burbank an inventor and Mr Ford was particularly fascinated with the mass production technique Mr Burbank carried out with plants, and which was so similar in principle to the mass production in Mr Ford s automobile plants.

By the time he was sixty three years old, Luther Burbank had created and introduced for man s use two hundred and twenty new varieties of trees, vegetables fruits and flowers.

He started to work with the potato sweet daisy and bean in 1873. He started with black

in 1874 He experimented with the gooseberry blackberry raspberry Juneberry strawberry and currant in 1878 Prunes were added in 1879

In 1884 in addition to continuing work with the previously named plants he added the pear quince peach chestnut loquat and the persimmon He began work in earnest with plums grapes, and the verbena in 1885 In 1886 he added work with apples and almonds. In 1887 tomato experiments were begun.

We might go on and on naming additional plants which were added to his garden each year but we would have to emphasize that the plants previously mentioned were still growing by the thousands. His interest in them was perpetual It would be very difficult to mention any plant which did not have his attention at some time

He created seventy-three new flowers. He introduced sixty-six new kinds of fruits which grow on trees, and twelve new fruits which grow on bushes. He produced nine new vegetables one new grape one new groundnut seven new tree nuts, and thirty five varieties of a new kind of cactus for feeding livestock

It is impossible to compile a complete list of all the new varieties of plants Luther Burbank created Many of them were sold to seed men and nurserymen who gave them new names without any reference to their originator Some of them such as the *Shasta* daisy have become so common that no reference is made in many seed catalogues to the fact that they were originated by Luther Burbank And many seedsmen list several varieties of the *Shasta* daisy

However the list at the end of this book of two hundred and thirty four new varieties, representing more than forty-six different kinds of plants will illustrate the wide variety of work he did.

Among the most interesting of the new plants produced by this plant magician, were: The white blackberry a

spineless cactus which produces more food for livestock in one year than any other plant, plums larger than any before known to man cherries that are ready to eat in February a white daisy larger and more beautiful than any Nature had prod ced without his help a plum without a seed and a delicious blackberry whose stems had no prickles whatever

Most people think that only a plant mag cian could induce Nature to make such drastic changes but just as the tricks performed by the magician on the st ge are really very simple in operation so the methods used by *Luther Burbank to perform his plant magi are simple* They are methods which can be used by anyone who would like to help Nature create new and interesting plants.

JOHN Y BEATY

LUTHER BURBANK
PLANT MAGICIAN

I A BOY ASKS WHY ?"

Luther was lying n a big flat stono his baro feet partly cov red by the water in the pond. He was watching a snail feeding on a water plant.

M ing slowly but steadily the snail crawled to a leaf of the plant just bel w th surface. Then still watching, Luther blinked and rubbed his eyes because he could not believe what he saw Th snail was walking upside down on the under surface of the very thin film that covered the water !

Because Luther could not see the film it seemed as though th snail were walking on nothing Then he began to realize that the snail did have something to walk on after all. He had heard some of the men who visited his father toll of the film which covers the surface f all water but it had never seemed to him that this film could strong enough to hold up a weight like that of the ge snail.

Luther could see the snail's eyes at the base of two long feelers. When one of these feelers touched another plant the snail stopped and explored moving the feelers this way and that. Then it walked down the leaf of the new plant.

While the snail was walking upside down on the under surface of the water film Luther could see its mouth opening and closing as though it hoped to find another plant leaf it co ld chew He could see the way its one foot operated. While a snail seems to move very slowly the parts of the singl foot can be seen to move rather rapidly as it glides just below the water surface.

The snail started to eat the leaf of the new plant on which it had foun l a resting place. Luther watched it for a while longer until his attention was attracted by another animal—one he had not seen before. It was crawling

slowly up the stem of a cattail plant. It was light brown in colour and about two inches long. It had six legs. Slowly the animal crawled and when it was about eight inches above the water it stopped and remained very still.

Luther watched it until he heard the farm bell which his mother rang to call the family to lunch. He returned in the afternoon and then noticed that the shell of the animal was beginning to crack along the back. What in the world could be happening to this insect? He had concluded that it was an insect, because only insects have six legs.

As the crack grew larger Luther could see that there was a soft skin inside. And he could see that this animal's inside body was pushing against the outside shell thus making the opening wider and wider

After several minutes the upper portion of the animal was pulled from the shell, and then Luther co ld see that it was the body of a dragonfly

At length the tail portion came o t of the shell. Then the wings slowly unfolded, for they had been tightly pressed against the back As th wings unfolded they were stretched out at the sides and finally they became rigid Luther was so fascinated by this strange transformation that he forgot abo t the tim and was late for supper

At home he told his father what he had seen

Yes said his father you have seen a dragonfly break through its skeleton and enter into adult life "

But why does a dragonfly live in the water?" asked Luther

"The greater part of a drago fly life is spent on the bottom of a pond or stream his father xplained. It doesn t look l k a dragonfly then. It looks like the animal you saw crawl up the stem. In that stage of its life we call it a nymph

"The mother dragonfly lays her eggs in the wa When the babies are hatched out of the eggs, they

the bottom where they find their food. The dragonfly nymph eats all sorts of tiny living animals, great quantities of them. In fact, it will eat another nymph if it can find one

Does it swim? asked Luther

N While it is in the water it is able to move about by using its legs. It also squirts water from the rear end of its body to force itself quickly here and there But after it is transformed into a full-grown dragonfly and lives abov th water it can move about only by flying It has six legs, but t can t use them for walking. The legs are so placed as to make a basket or trap with which it can catch mosquitoes and other flying insects as it darts through the air"

Why does it catch insects? asked Luther

"While it flies, it holds this basket near to its mouth and eats what t has caught said his father When it alights on a plant stem it does not walk It must take off from the same spot on which it landed Its legs are made for catching food. They are not made for walking."

During the many trips Luther made to the pond he observed tadpoles, minnows, turtles, frogs, crayfish red winged blackbirds, herons and that strange animal, the leech. One day he found a large leech—about two inches long—attached to the neck of a turtle It was fat because it had just enjoyed a full meal of turtle blood.

Luther took it home and placed it in a jar of water by itself For several months, he kept it this way without food. It is true that the leech was then smaller than when he put it into the jar but nevertheless it was still alive. By this experiment, he learned that a leech may live as long as a year on one meal.

Leeches are sometimes called bloodsuckers. And indeed, that is a good name because they suck the blood of animals. They do it in such a way that the victim does not realize that they are stealing the blood the animal itself needs.

The leech has sharp teeth with which it punctures the skin and the blood vessels. But it instantly injects a fluid which affects the nerves in such a way that they do not send a message of pain to the brain of the animal. In other words, the leech can suck blood from an animal without causing any pain at all

Luther might have learned these things about water plants and snails, dragonflies and leeches, by reading after he was older But he always remembered what he saw for himself in the pond and what his father said in answer to his questions.

2. WHAT FARM LIFE TAUGHT

Living things fascinated young Luther Burbank and he spent most of his time learning about the plants and animals which h lp to make this world a beautiful place As if to prepare him for the impor tant use he was to make of the heredity and environ ment of plant life his early environment and his family helped him to grow up w th a knowledge of the country

Luther Burbank was born on March 7 1840 on a farm near Lancaster Massachusetts As a baby he must have looked out on the lawn and elm trees blanketed with the snow of the lo g New England winter But inside the big red brick farmhouse heated by log fires, it was warm en ugh for babies and house plants to be comfortable Luthe s mother was fond f fl wers and she found she could keep the baby happy and quiet by giving him a flower to hold in his own hand. Turning th blossom in ' tiny fingers he would look at it seriously curiously and forget to cry

As the baby grew the world changed his father Samuel Walton Burbank, owned many acres covered with trees which were cut for lumber He also owned a clay pit from which he took clay for making pottery and brick. So there was always some interesting activity to take a growing child outside the house. Most important of all, there was a meadow a stream and a marsh in which all sorts of living things attracted the attention of the boy as he grew older

Luther started school at the usual age and although he was eager to learn school was somewhat of a trial be cause he was a very timid child It was the custom for each scholar to stand before the entire school to recite. That was most difficult for Luther After the teacher realized his timidity and allowed him to write his lessons, he got along much better

His school was conducted in a little one-room red brick building in the woods. It was held every day of the

week, except Sunday However every other Saturday afternoon was a half holiday This half-holiday was necessary to allow the children s mothers to wash their clothes. It was customary for each child to have only one suit of underwear and the children had to go to bed while their underwear was washed

Sunday was a quiet day because according to custom at that time even a walk in the woods was not advisable on the Sabbath. However Luther s parents, realizing how much he loved the wild things, were not very stri t on this point.

Although Luther was very fond of th out-of-doors, much of his time was spent in making things H made windmills and waterwheels. He made statuary and orna mental pottery from the clay in his father s pit

Luther mother Olive Ross Burbank, was his father's third wife and she had two children before Luthe but both f them died in infancy Luther was the oldest f his mother's family when his mother later had tw other children, a boy and a girl His father s older hildren had all gone away from hom to work by the time Luther was ten years ol l So it was natural that h should feel considerable responsibility for helping his mother in car ing for his brother and sist He also spent much time in helpi g her with her flowers and egetables.

Even before he was ten years ld Luth realized that this i a beautiful and a wonderful world and he wanted to know more about it. He wanted to kn w why some plants grow under the water while thers grow only above the ground why som trees have broad lea es and others have leaves as narrow as needles. H tried to guess how new plants were prod ced and old ones per suaded t change their habit of growth He wondered whether it would be possible to improve or hasten the processes f Nature—f r example to make plants grow faster so that his mother might have flowers and vegetables earlie in the spring.

Eventually he was to find answers to ll tl tions and to make practical use of the informati

3. A GREAT MAN GIVES A CLUE

Th Bu bank house had to be large enough to hold, not only the large family of children (Luther was his father s thirteenth child) but the ministers teachers and lecturers whom his father enjoyed entertaining. Some of the world s greatest scientists came to Lancaster while Luther was a boy and stayed as visitors on the Burbank farm

Although L ther knew that these important men would be talking about something that he wanted to learn he was so timid that he d d not enjoy meeting the strangers But he did want to hear what they had to say so l often sat on the ground outside an open window to hear his father ask questions and the visitors answer them Every fact thus discovered was a treasure to him because he had very few books to read. As a matter of fact v ry f w of the answers to his questions were to be found in books at that time

As he grew older he became less timid and he then asked questions himself. In that way he was able to learn more and more

Professor Levi Sumner Burbank, his father's brother often lived at Luther s home for several weeks at a time He wa in charge of the department of geology in the Museum of the Boston Society of Natural History and he made many long trips with the famous scientist Louis Agassiz Luther was very fond of his Uncle Levi, who was willing to take his young nephew into the fields and woods and tell him interesting things about Nature.

With his uncle s help Luther learned that he could understand many of Nature s secrets if he studied the flowers, trees, insects and larger animals for himself. Often instead of playing games with other children he walked through the woods and into nearby fields to see

what the interesting living things were doing He saw the flowers thrust up their first leaves in the spring. He saw the frail petals of the blossoms appear He watched the bees as they carried pollen from one flower to an other Then he saw the flower petals fall, and the seed pods develop.

In this way he early learned that many flowers live their complete lives in one short season. The seed ger minates in the spring; the plant dies in the fall But he observed that other plants, like the trees, live much longer lives. Some of them live longer lives than men.

Some plants, he also discovered live very strange lives and do queer and unexpected things

Luther had noticed a certain kind of plant in the pond which grew entirely below the surface of the water None of it came above. It had very fine leaves, and Luther thought that he saw little bags on the stems here and there

One morning, while he was lying on the flat stone looking for something new the sun shone on the water in such a way as to light up th place where there were several of these little bags. Luther saw som tiny animals swim into one of the bags. He waited to see them come out again but they did not reappear A little later he saw others swim in. None came out.

Then he looked at several of the other bags. Occa sionally he saw little animals swim into them but never did he see any come out.

"What in the world can happen to those little animals!" he asked himself

That evening in the living room at home, he told Professor Levi Burbank what he had seen. The professor was greatly interested

"Where was the plant!" he asked.

"I saw it in the pond," said Luther "While I was on the stone, I saw tiny animals swim into little

which grow on the stem of this plant. Dozens and dozens of little specks swam into the bag but none ever came out. Why was that?"

"That was because the plant ate them explained Levi Burbank.

"But, Uncle Levi how can a plant eat animals?" asked Luther

"The plants you saw said the scientist do not get all of the elements they need out of the food in the water There are certain things in the bodies of animals which these plants must have So they are provided with traps in which to capture food But how did you happen to see the littl animals caught by the bladderwort plant?

Is that what the plant is called? asked Luther

"Yes, said the teacher "the traps are called bladders.

Well, Luther explained the sun was shining on the wat in such a way that I could see very clearly I saw little pecks moving near the plant and as I watched me of them went into the bladders, I didn t know what was happening I di In t know the plant was going to eat them

"Besides the bladderwort several other plants eat animals" said the professor Most of them grow in swamps and bogs Several of these plants are called pitcher plants because some of their leaves are made into pitchers Insects crawl in from the top. After they get inside they cannot get out These plants grow above the ground but their roots are in wet soil. Pitcher plants eat insects just as the bladderwort eats tiny animals.

"There is another plant continued the scientist, which we call the sundew It has some stems which have a round disc on the end from which project tiny arms. On the end of each arm is a sticky substance. If an insect alights on one of these discs, the disc quickly f lds its arms towards the centre These arms come together so that the insect cannot get out.

"Well said Luther "I know that animals eat plants, but I did not know before that some plants eat animals Every livi g thing seems to depend upon something else doesn t it?"

You are right, Luther said the scientist Some plants help animals other plants help plants some animals help plants and some animals help other ani mals But at the same time there are some animals which prey upon other animals, and some plants which prey up n other plants. There are plants, for example which get all f their living from others. We call them parasites They cannot digest their own food so they live on other plants and take food which the hosts com pound in their leaves."

PLANTS THAT DRINK A STREAM DRY

Near the pond was a small stream full f water in th spring but usually by the first of July the water was gone. Luther wandered along this little stream, and even after the first of July he found some water in the upper part but farther down where the cattails filled the bed there was no water Luther had often wondered what caused this Now that he had a chance to talk with a scientist, he asked why there was no water in the lower part of the stream.

"The cattails drink all the water " explained Professor Burbank

Oh, but, Uncle Levi, objected Luther I don t think the catta ls could drink so much There is really quite a lot of water in the upper part of the stream.

You would be surprised to know how mu h water cattails can drink said the scientist. "Cattails often drink a stream dry "

Just how does a plant drink! Luther wanted to know

The professor then explained that a plant takes water out of the soil with its roots.Water goes to the leaves

and some of it is used there in the making of food but most of it passes on into the air The cattails, when they drink a lot of water as they do when there is plenty of water in the stream, give off great quantities of it into the air As a matter of fact all land plants give off water into the air but cattail plants evaporate more than many others. It has been learned for example, that an acre of grass can give off as much as six tons of water in one day!

Well mused the boy after listening to his uncle, every plant seems to have something about it that is very strange I want to know more about plants

Luther wanted to learn more in order to do more he had discovered that those who understood the ways of plants could indeed work with Nature to change long-established habits f growth When he was only fourteen years old his Uncle Levi taught him how to cut a small branch from one tree and graft it on another In this way he was able to make pears grow on an apple tree, and apples grow on a pear tree

Luther's most important lesson was learned from the great scientist, Louis Agassiz of Harvard University at Cambridge Massachusetts. Luther did not go to Cambridge the great man came with Professor Levi Burbank on one of his visits to the farm

While Dr Agassiz was visiting with his father Luther managed to ask several questions about the way new plants are made. Dr Agassiz explained that before a seed can be formed the pollen of one plant must be brought by the wind, by the water by a bird by an insect, or by man and some of it must become attached to the little finger called the pistil which is usually found in the centre of the flower

The end of the pistil is sticky When the pollen adheres to this, it develops into a pollen tube which grows down through the stem of the pistil and into the ovule There the sperms in the pollen join with the tiny female cells which then grow into seeds

"Seeds however are never made explained Professor Agassiz, 'unless pollen is brought to the pistil. If the pollen comes from a flower of a different variety the seeds will grow into new plants which may be better or may be much less useful, than the plant on which the seeds grew However the two plants supplying pollen and pistil must be related, they must belong to the same species or genus.

"Then " said Luther "the way we get new varieties is to take the pollen of one plant and put it on the flower of another!"

"Exactly agreed the great scientist. "When we do this, we help Nature bring about improvements. That is we do if we destroy all new plants which are of less value than those we already have.

"For example you might produce a thousand seeds by crossing the pollen of one plant with another and only one of the thousand might grow into a pl nt which was better than the plants we already have If you allowed the other nine hundred and ninety-nine to continue to grow the world of plant life would become less useful rather then more useful. Nature has ways of destroying these less useful plants but man can greatly help her "

"By killing weeds suggested Luther having in mind his own experience in his mother's garden.

But here Dr Agassiz made another important observation "W often call weeds pests when there are too many of one kind. When great quantities of them interfere with crops, we destroy them but so called weeds may be developed into valuable plants.

Perhaps Luther did not realize it then, but in this short lesson given him by a famous naturalist, he had the basis for his future life work. Dr Agassiz had told him how to be a plant magician

In the days that foll wed, Luther made long into the field to study plants. One day while he

only when it first opens. It is necessary to transfer the pollen just as soon as possible after the blossom has begun to spread its petals.

H also discovered that the black head in the centre of a black-eyed Susan is made of many tiny flowers. One flower is a tiny tube in the centre of which is the pistil and the stamens and there are many of these tiny tubes in one flower head. Professor Burbank explained to him later that the black-eyed Susan is called a composite flower because the petals surround a great many sets of pistils and stamens instead of one set. The composite has many flowers surrounded by one group of petals.

As he studied the blossoms in the fields d y after day Luther began to realize that he could control conditions better if he had some of these plants in his garden. At the time this thought came to him he was walking through a field of oxeye daisies. H selected two plants which he thought he would like to work with and, having no tool but his pocketknife with him he spent half an hour carefully digging these plants out of the ground.

He took them home and planted them in a sunny place in his garden. There he watched over them carefully When his father saw them, he said, Luther I wish you would dig those weeds out of the garden and destroy them"

Oh but father pleaded Luther I planted them there.

"You--you planted them!" sputtered his father amazed. "Why did you plant weeds in our garden? It is hard enough to get out those which start by themselves."

"I want to try to produce some new varieties, said Luther

"New varieties of weeds? asked his father "D. we have enough weeds as it is? The poor farmers plain bitterly because there are too many now

Perhaps, said Luther "we can make a flower that will be better than the weed I ll promise that if you will let me keep these oxeye daisies in the garden I will not allow them to become weeds here."

Well his father conceded "you may do that It will be a good way for you to learn some of the things you need to know about plants.

While the oxeye daisy was a troublesome weed to the farmers near Lancaster Massachusetts it wa a prized possession of the young Luther Burbank. He did not know then how important it would be to his future life. But it turned out to be one of the most valuable flowers with which he experimented. With its help, h later astonished the world.

As Luther carefully transferred the pollen of the two daisy plants he had brought from the field he hoped that he might harvest seeds to produce new varieties. He took the pollen from one plant and put it on the flowers of the first one. In that way he crossed the pollen both ways.

He waited eagerly for the seeds. When they ripened he collected them carefully. He planted them the next year with high hopes.

By this time he had interested his mother in what he was doing and she encouraged him in his experiments. He watched the bed in which the seeds were planted and learned many new principles of plant life.

As soon as the new daisies began to show above the soil, he saw that each one was different. Some grew faster than others; some were a darker green than others. Some stems were covered with fine hairs; others were more nearly smooth. Try as hard as he would, he could not find two plants which were exactly alike.

At first, this disturbed him. "If everything [illegible] different," he asked himself, "how can I multiply a new flower if I find a new variety I want to keep?"

Later he was to learn the answer to that question.

When the blossoms came, they proved that the crossing of flowers by exchanging pollen does produce a great variety of new plants. But none of the blossoms was really beautiful. Most of them were very tiny; they were all disappointing.

Luther talked with his mother about the discouraging results of his experiment.

"I want a daisy," he explained, "which is [illegible] and which has a blossom very much larger than [illegible] ever seen. Not one of these new plants is [illegible] worth keeping."

Perhaps you shouldn t expect something better from this small number his m ther suggested. It may be that there is only one better flower in many many thousands. It is possible that you may work an entire lif time to produce just the type of flower you want B t some of these plants may help you in future crosses. Why don t you hunt for a better flower in the field and bring ts pollen here to put on some of these?

Luther followed his mother s suggestion, but the results the following year were just as disappointing as those f the first. Then Luther admitted to his father that his effort had not brought the hoped for results.

What are you going to do with these new weeds you have created? asked his father

I am going to pull them out and burn them, said Luther sorrowfully Dr Agassiz said that new plants which are less useful than the ones we have should be ᵤ And these are worse than the daisies in the d. They are all new varieties, but none of them is any good

'That is a splendid idea said his mother 'When you have something you are sure is valueless it is best to waste no more time with it.

Luther did not realize it, but that statement of his mother was to be important in his future work. All his life he made it his practice to burn those plants which were valueless, just as soon as he was sure that they would not be useful to him in further tests.

Luther burned the weeds as he had promised but as he stood watching the fire he continued to have visions of the daisy he would like to produce

It must be very large " he repeated to himself, and it must be very white. A white daisy with a yellow centre against a green background of foliage would be the most beautiful flower in the world. I know now that I can produce new varieties. , I shall keep on trying until I get the new flower I want."

Luther s early experiments were not confined to the daisy He collected some of the New England asters which had purple flowers, carried the pollen from one to the other and raised plants from the seeds. He carried on so many experiments that his father complained that he had turned the vegetable garden into a field of weeds.

Luther's mother however explained to his father that the boy was learning some important lessons and the little amount of ground he used was no loss, because Luther was taking good care of the vegetable garden and the family had plenty of vegetables to eat

Luther's experiment with the asters further showed that he could get new varieties Some of the blossoms were of entirely new colours, others had petals which were twisted and curled. The foliage of some was striped. There were all sorts of variations.

However none of them was better than the wild asters which had been produced and perpetuated by Nature herself. Luther burned the results of these experiments, saving some of the seeds for further tests.

One day Luther's father read a letter from one of his two sons who had gone to California. In the letter Luther's brother said that the climate in California is such that plants grow the year around

"That is where I want to go Luthe announced 'It takes so long here to get a new plant from seed. A seed that is produced one year cannot be grown until the next. If I were in California, I could plant the seed which I grow this spring as soon as it is ripe and I could see my new plant in just a short time.

But California is a long way from here, bjected his father It would cost a lot of money to get there It would take several days on the train.

"Then announced Luther firmly I shall save my money until I get enough to go.

His father and mother were talki g over Luther s ambition that evening, and his mother asked Do

think that Luther will really save enough money to go to California!

"Don t worry commented his father It will take him so long that many things may happen in the mean time He will perhaps have other ideas which will take the place of those he had today I don t believe that there is any chance of his going to California.

But Luther was sure that what he wanted most was to go where he could grow more plants in a season.

A plant that starts from seed in the spring and dies after it produces seed is called an 'annual.' Its life from seed to seedpod is called a generation. In California, Luther could get two and perhaps three generations each twelve months whereas in Massachusetts he could get only one. Each generation of plants, when you are trying to work magic with them is a necessary step in improvement. Only rarely does improvement come in the first generation Luther realized this and that is why he wanted to live where he could grow about two generations a year

Meanwhile he was living where inventive genius turned naturally to mechanical devices. In New England, at that time even a boy whose mind turned to experiments with plants was certain to try making things with tools. Usually whatever Luther did had a practical value and now that he wanted to save money he gave more attention to the making of things which could be sold

He had experimented with a steam whistle Using an old teakettle with a whistle fastened to the spout, he demonstrated to the astonishment of his young friends that steam has power—at least power enough to blow a whistle.

Luther then developed this idea further and eventually had built a small steam engine which had enough power to move a rowboat through the water He sold this

steam engine and gave the money into his father's care to save for his trip to California.

Because of his son's mechanical ability his father thought that Luther should become a mechanic. It happened that his uncle, Luther Ross, was superintendent of the woodworking department of the Ames Manufacturing Company at Worcester Massachusetts. Luther's father arranged for the boy to work for his uncle.

Luther was interested in this work, not only because he wanted to earn money but also because he liked mechanical things Probably mechanics came second to working with plants, among the things he liked to do

His job at Worcester was the turning of plow rounds on a lathe. He was paid fifty cents a day But while he was away from home he had to pay for his board, and his board cost fifty cents a day He worked six days a week but as he had to pay for his food on Sunday the same as on any other day he earned each week fifty cents less than he spent.

This did not appeal to his practical nature so he asked his uncle if he might work by the piece—if he produced more plow rounds, he would be paid more When his uncle agreed Luther made twice as many rounds in a day as he had made before and earned twice as much money Then he had something left to sav f r his future.

Even this advance in earnings did not entirely satisfy him. H was always watching for a method by which he could improve his work. One day he went to his unel with the announcement that he had built a device with which he could turn out many times more plow rounds than was common on the ordinary lathe then used. This attachment which he had invented enabled him to earn as much as sixteen dollars a day!

Perhaps this unusual success should have made him satisfied with a career as a mechanic and inventor the great amount of dust which he breathed in

working shop was a detriment to his health. He had never been as strong physically as others although he was very active Now the dust had such a bad effect on him that he had to leave his uncle s employ

He returned home and devoted his time to the raising of fruits and vegetables for the local market. Even in this wo k, he used his inventive genius. One of the first things he did was to build a dam across a stream on his fathers s land to mak a larger cranberry bog Cranberries must grow where there is plenty of water And, in order to have a larger crop Luther made a larger area on which the cranberries would grow

The railroad engines of that day burned wood and Luther s father sold wood from his timberland to the rail road One day while Luther was working near the railroad track he discovered a fire which had been started by sparks which flew out of a belching railroad locomotive. Already his father s timber was threatened.

It was three miles to town where Luther knew he must ...lp, and the only way to get there was to run It ... a hot day but Luther started running He secured ...e necessary help but he was partially overcome by his excessive xert on in the hot sun and was ill for many days This experience weakened his health even more and proved to be another reason why he never went back to the woodworking shop or to mechanics as a career

While the doctor was caring for him during his illness, Luther as was his general custom asked many questions. Information about the human body interested him so keenly that he concluded he would like to be a doctor The local physician took an interest in him and helped him study medicine for a year

Luther might have gone on with this study because he liked it tremendously but at about the end of that year his father died. Later the family moved to a nearby town called Groton, and there Luther began his future work in earnest, again devoting all of his time and energy to the raising of vegetables for sale

Now there was real responsibility. Luther's savings had helped the family in the emergency and he must find a way to make more money. So he was continually looking for improvements in vegetable growing. He observed, for example that his customers were eager to have sweet corn as early in the summer as possible. It occurred to him that if he could produce sweet corn earlier than any other gardener he could ask a higher price. But since it would take too long to produce a new variety that would mature earlier he invented a method which could be put to use at once.

About a week before it was possible to plant corn in his garden he put the seeds in a pan of shallow water where they swelled and started to germinate. Then when he placed them in the ground they had a start and would grow to maturity many days before tl corn grown in other gardens. In this way he was abl to have sweet corn for sale before anyone else. H gained many new customers and also received higher price for his early corn.

But he did not stop thinking bout the ways of Nature, which must be understood in order to achieve these practical results. In these years when Luther Bu bank was growing to manhood, one the world greatest scientists, Charles Darwin, was conducti g experiments and writing about them in England. About the time Luther was twenty-one years old he was given one of Darwin books entitled *Animals and Plants Under Domestication*. This book enabled him to be even more certain that he could ontribute more to this world by creating new varieties of plants than by any other kind of work.

He read every word in Darwin s volume carefully. He mad use of the principles it described, and he became more and more sure that what he wanted most was to be free to pend all his time producing new plants.

The fact that no on else had ever done it

couraged when someone told him that what he wanted to do could not be done.

Although he was now only twenty-one years old, he had learned many times that Nature has few limitations in what she can produce. He had also demonstrated that man can aid Nature and help her to mould new lives of any type desired.

He still had the ambition to go to California. His success as an inventor he believed merely demonstrated that he could create new plants. After all a new plant is an invention just as much as a steam engine of original design is an invention. This principle has now been recognized and a new plant may be patented just as a new machine may be so protected.

5. POTATOES PROMISE A FUTURE

The possibility of finding a future in a potato patch would not occur to many young men and Luther Burbank had no such hope in his mind one day when he was going through his potatoes he was looking for potato bugs. To him, each plant was like a personal friend, and he did not want an enemy bug to eat a single one

Suddenly he stopped in amazement He saw a little round green ball. It was not a potato bug, but something seldom seen on potatoes. Luther Burbank future was actually inside that little green ball

Luther knew what it was knew the possibilities of using it as a *source of money for his move to a climate* where he could grow three generations of plants each year For the little green ball at which he was looking was a seed pod. In it, he was later to find twenty three seeds, each one of which would grow into a potato plant on which a new variety of potatoes would be produced.

It is not often that a potato plant produces seeds For many generations we have grown potatoes by cutting the tubers into pieces and planting them now the plant seldom produces a seed

This little seed ball was not yet ripe in fact it was only beginning to grow Luther knew that he would have to be patient f r many d ys before it w uld reach its full size. He knew that he would have to wait until the seeds had ripened before he dared to pick the pod from the plant.

Thrilled with the prospect he wanted to stay in the garden and protect that little green ball all day and all night. His mother didn t agree with that idea, however and so he had to trust the tiny sphere to the elemen hope that nothing would happen to it to prev planting the seeds

The plan which developed in his mind during the first minute after he saw the seed ball was that he would grow new varieties of potatoes and sell them to a seedsman He would go to California with the money thus secured

Of course he had no assurance that any of these seeds would grow into varieties which would be of any value whatever He had experienced many disappointments with other seeds never yet had he produced a new variety that was worth more than the old kinds. But these experiences had taught him that he must be patient and he never lost hope He knew that it was impossible to foretell when a new and better variety would appear

A TRAGEDY IN THE POTATO PATCH

Every morning after that, Luther rose early and went to the potato patch There he stood looking at the little green ball containing the seeds on which he felt his future depended. He examined it at different times during the day Every evening before he went to bed he made sure that the seed ball was still safe. And after he went to bed at night he dreamed of the plans he would carry out with the money he expected to get from the new varieties of potatoes.

One day when the seeds were nearly ripe he went to the garden to dream a few more happy dreams about his future in the warm climate of California. When he came near to the plant where the seed ball had been growing his heart almost stopped

The ripe seed ball was gone!

Who could have taken it? Who except his mother knew it was there or knew its value? He had not spoken to anyone else about it.

Without seeds, he could not produce new varieties of potatoes. Potato seeds grow so seldom that he had no idea when he might find another seed ball.

What chance had he of getting the needed money now? The few potatoes he could sell from this crop would

not bring very much. The real prospect for his future lay in that seed ball which was now gone. What was he to do?

Luther dropped to his knees on the soft earth Nervously he turned over every piece of dirt. He examined every quarter inch of space under the plant on which the seed ball had grown, the seeds were not there.

He looked under the next plant, and the next one and the next one. He had made up his mind that he would examine every inch of ground in the garden.

It was growing dark when his mother called him for supper He didn t want to give up the search, but he could not hope to hunt again until daylight.

For several days, he hunted in vain. Finally one evening, when his mother called him for supper he answered with a shout. I ve found it! I ve found it! He shouted at the top of his voice "I ve found it, Mother!

His mother of course was astonished. When Luther showed her the seed ball, she laughed and said, 'You shouldn t get so excited about a little thing like that."

"Little thing? repeated Luther Mother this is the biggest thing in my life! With this seed ball, I may be able to get enough money to really get started!"

What do you mean—get started?' asked his mother

I want to create new fruits, vegetables, trees, and flowers," announced Luther

'That is a worthy ambition his mother agreed but I do not know how you are going to learn that business. It takes a scientist to do work like that.

"I know how to do it now! declared Luther with a confidence which amazed his mother I have been reading books and talking with scientists and I know just what to do to make new plants If I plant the seeds that are in this seed ball, a new kind of potato will each seed. Some of the new potatoes may,

but some of them may be better than anything we now have If they are, I am going to sell them and get enough money to go to California.

If you get enough money from selling the potatoes that come from those seeds, his mother promised "you may go"

Luther felt this was the happiest day of his life. He knew of course that it might happen that not a single seed in that ball would produce a potato that would be as good as those already in existence. Later on he planted thousands of potato seeds secured from all over the world and was able to select only one new plant which produced potatoes which he thought were better than those already being grown in the United States. It is not often therefore that a potato seed will produce a new variety which will be usef l

But now Luther felt that somehow he was going to get what he wanted Something told him that next year he would have the long-awaited chance to begin his real work.

Luther guarded the seed pod all through the winter In the spring he planted the twenty three seeds which were inside the pod and each one grew Those twenty three potato plants were given better care than any plants ever had before, and when the time came to dig the tubers Luther still had confidence that he was going to get what he wanted

He dug the potatoes which grew on the first vine There was no question but that they were of a new variety But the tubers were worthless. They were small and twisted

The second hill was just about as disappointing as the first one. But Luther did not lose hope There were twenty-one more hills to be dug

Number three proved to be worthless and so did number four

Number five looked much better but Luther was in doubt as to whether it was as good a potato as the Early Rose variety from which the seeds had been taken.

Hill number six yielded beautiful potatoes. They were large and smooth and white There were eighteen in th hill. Luther could not be sure but he felt that here was a variety that might be sold.

The next one he dug looked even better After he had finished digging all the hills, he believed that he had obtained two new varieties which were better than any potatoes he had ever seen.

The young man believed that these new varieties were what he had so long hoped for but he knew that he must test them by growing a crop before he could sell them to a seedsman.

He planted both kinds in separate patches th next spring, and harvested the crop in the fall One gave him more than twice as many bushels of potatoes to the acre as were commonly grown when tubers f other varieties were used. The other one did not yield quite so well So he decided that the best-yielding variety was the one to be sold.

He sent some of the tubers to two seedsmen asking them to make him an offer One seedsman sent back word that he was not interested. The other one, Mr James J H. Gregory of Marblehead, Massachusetts, sent word that he would try the new potato in his own garden and let Luther hear from him later

Luther planted this new variety again, and the next fall, after his own harvest, he received word from Mr Gregory that there was a possibility of his being inter ested in buying the new strain He invited Luther to come to see him, and Luther asked a friend of the family Mr J T Brown, who was a banker in a near by town, to go with him.

After the visitors had introduced themsel

Gregory showed them a basketful of potatoes. They were large and smooth and white.

"These are the best potatoes I have ever seen," said Mr Gregory. "I grew them in my garden. And I grew them from tubers which this youngman sent to me a year ago."

Mr Gregory asked Luther if he would sell him the potato outright giving him the exclusive right to introduce it. This was exactly what Luther wanted to do. He much preferred to have at once the money to which he was entitled, so that he could use it to go to the Pacific Coast.

When the banker asked Mr Gregory how much he was prepared to offer Mr Gregory said $150 cash. Luther had hoped that he might get $500. Mr Brown tried to persuade Mr Gregory to pay more, but the seedsman said that there was a strong likelihood of other new potatoes being introduced and he couldn't afford to pay more than $150 for Luther's crop. Finally Luther agreed to this price, and the money was paid.

Mr Gregory let Luther keep ten potatoes to take with him to California, and gave him the right to introduce them there. The seedsman said he believed the new variety should be named the *Burbank Seedling* because a person who produced a new variety deserved to have it bear his name.

The young man's heart was bursting with joy. His thoughts already in California he said scarcely a word to Mr Brown as they drove home together but the banker offered some good advice.

"You won't have too much money to start on," said Mr Brown, "but if you are careful and if you work hard—above all if you hold to your purpose to produce new plants for the benefit of mankind—you can be sure of making a living."

Luther followed this advice Throughout his life, he never allowed the desire to get money to change his purpose in any way his first desire was to produce new plants which would benefit his fellowmen

In time the Burbank potato was used so extensively especially in the northwestern states, that not less than $17 000 000 worth of this one variety was grown each year

It is hard to realize that mankind can benefit so much from the result of one tiny seed But who can say whether if Luther had not hunted earnestly for the lost seed ball, and then planted the seeds it contained, the world would have the benefit it now enjoys from the wide use of the Burbank productions?

6. THE GREAT ADVENTURE BEGINS

When Luther returned home with $150 cash he was eager to leave at once for his new home. However he owned seventeen acres of land, tools, seeds, and other equipment which must be sold before he could go. It took some time to dispose of these various salable articles, and then with all his available funds gathered together he had only a little more than enough money to pay his railroad fare across the continent.

When the day of parting came he bade his mother good-bye with mixed feelings of regret and happiness. He was sorry to leave his mother but his clearly formed ambition to experiment in producing new plants made him realize that he was doing the right thing in going where his work could be carried on more effectively.

His mother prepared plenty of food for him to carry on the train and in addition to a few extra clothes, his baggage further consisted of seeds of various kinds with which he wanted to work in California—and the ten Burbank potatoes. Without a doubt it was the box containing those ten Burbank potatoes which gave him greatest comfort on this long lone journey of three thousand miles.

Poring over maps of California many times before he left Massachusetts, Luther had finally concluded that he would go to the little town of Santa Rosa. The name was attractive but more than that investigation of the country convinced him that this was an ideal location for the kind of work he wanted to do. So he paid his fare to Santa Rosa.

Railroads were not so well developed in 1875 as they are today and the trip from New England to the Pacific Coast required nine days at the best. Moreover the train did not always keep up to the schedule. But when-

ever there were delays, some of which amounted to an entire day Luther would open the box of Burbank potatoes and examine each of the ten specimens carefully

Before he arrived at his new home he knew every spot, every eye every wrinkle on each one of those ten tubers. He recalled again what he had learned earlier in life No two things in Nature are exactly alike. Each one of those ten potatoes, although they were all of the new Burbank variety had its own individuality

Perhaps, they were better companions for him than human beings would have been, for they encouraged him to plan for his future. They gave him confidence in what he had already accomplished, and they were an inspiration to lead him on.

One day the train came to an unexpected stop far from any town. No houses were in sight in any direction. When Luther took advantage of the opportunity to get off and walk a short distance he discovered that the reason for the stop was a hot axle The trainmen told *him that they would have to wait until the axle cooled,* which would be sure to take two hours, and possibly longer

Luther walked a short distance out on the prairie and saw many interesting plants with which he had not fo merly been familiar This gave him an opportunity to dream of improvements that might be made in those plants. Any farmer would have called them weeds, but Luther saw the possibility of beauty and usefulness in each one. H was soon to have the coveted opportunity to work for such improvements.

When he returned to the train, he was informed that there would be a further delay of two or three hours. As a matter of fact, the train did not get started on its way again until th end of the day

Luther went back to his seat and read from one of the books he had brought with him. He had read

entire book before—many times in fact. But he pored over it again, benefiting from what he read more than the first time because of the experiences he had enjoyed since the first reading

He had marked certain passages on pre ious readings. Those passages now meant even more to h m He had seen more of this great country of ours and realized the need f r improved plants which may be used by farmers to produce food and clothing and other essentials for human beings.

With a stubby pencil, he drew a diagram on the blank page at the end of this book. On this diagram, he divided a plot of ground into several sections. This was his imag inary experimental garden. He decided to plant in one portion the ten potatoes he was guarding so carefully Next he made room in his garden for all of the seeds he had brought from Massachusetts, and allowed additional space for seeds which he had gathered on the prairie while the train was waiting for the axle to cool

As he was tracing this diagram he realized that he would need money to support himself after arriving in California. He must allow space in this imaginary garden for producing vegetables which could be sold immediately but this brought him to the stern reality that land is not bought without money He would have to work at whatever occupation he could find until he could save enough to buy the land he needed.

While the train was stopped on the prairie one of the passengers came and sat down in the seat across the aisle from the young man and talked to him. Luther listened attentively learning that this man had lived in Santa Rosa and was able to supply information about the little town.

Then his fellow-traveler asked what was in the box. Luther opened it and displayed the beautiful white *Bur bank* potatoes.

"Where [illegible] young man?" asked [illegible]

"I [illegible] dued myself."

The man [illegible] variety of potatoes [illegible] that scientists and professors [illegible] worked [illegible] fellow like you [illegible]

"Well," said [illegible] variety from seeds [illegible] toes in Massachusetts [illegible] them to [illegible] setts. He [illegible] lings [illegible] am going [illegible] vote my whole life [illegible]

By this time [illegible] was looking at [illegible] what you say [illegible] did you get [illegible]"

"I have had [illegible] ed. "My father's [illegible] helped me [illegible] Then I talked with [illegible] things from him. [illegible] learned in the fields [illegible] helped me more than [illegible]

"Go on, young [illegible] terest me."

"Nature taught me," continued Luther [illegible] plant that comes above the ground is different [illegible] all others that exist. Yet it is possible to [illegible] so that others which come from it will be quite similar and will have the same important characteristics.

I have seen Nature demonstrate this many times [illegible] you wish I will take you out here on the

prove to you that there are no two flowers in that little patch of asters there which are exactly alike

"You are pretty sure of yourself aren't you!" commented the stranger

Yes sir agreed Luther "I have examined many groups of plants and found that there is always a difference between the separate individuals So I am not afraid to say that I can show you differences in the blossoms in any patch of flowers no matter whether I have ever seen the patch before or not.

What else have you learned ? encouraged the stranger "Tell me more"

I have learned continued Luther that when seeds grow on a potato plant each seed will produce a new variety That is how I was able to produce this Burbank Seedling which I have shown you"

H w about the seeds of apple trees ! asked the anger

Every seed from a fruit tree also produces a new iety said the young plant magician. Fruit trees of he same kind are reproduced only by grafting The bees and other insects take care of the crossing of pollen on fruit trees. The crossing has been done for so many generations that fruit tree seeds are already prepared by Nature for the production of new varieties.

"Well," said the stranger "you seem to be so certain that I am now going to ask you a question which will certainly confuse you. If Nature is so lavish in producing new kinds of plants, how is it that this prairie is not literally covered with millions of new varieties!"

"I can answer that question sir said Luther confidently The new variety begins as a single individual The old varieties grow in great numbers. Single individuals cannot always thrive in a place where they are in competition with older established kinds. It is rarely that a new variety gains headway because the established kinds crowd it out. That seems to be Nature's way of preven-

ting inferior varieties from taking the earth It is the better variety only that succeeds."

"Oh," said the man, "you are propounding the theory of the survival of the fittest."

'Well said Luther 'I don t know whether that is the theory I am propounding or not. I have never called it that. But I have observed in Nat re that only those plants which are strongest survi e and reprod ce themselves. And it seems to me that hardiness i the chief essential for success. So I m going to mak it my first principle I'll introduce only those new plants which demonstrate hardiness They must be able to live in competition with others, and survive under difficulties. I am not going to introduce new plants which must be pampered.

Well" complimented the stranger I must say that you have high ambitions, and I wish you the greatest of success. Evidently you have put much more tho ght on this subject than I have ven though I am in th nursery business in California. Perhaps I will be your competitor

"We must have competition said Luther For just as plants demonstrate their hardiness against competition so man must do the same thing If I m not hardy enough in my work, you may prevent my thriving by selling your products to all of the customers to whom I should like to sell."

Oh don t be pessimistic, said the man. "I m not going to interfere with your plans."

"I'm not pessimistic" said Luther "I m simply telling you that I understand the importance of hardiness. No matter how beautiful, how juicy how sweet a fruit may be, it shall never bear my name unless its gro sufficiently hardy to withstand the vicissitudes scorching summer sun and the trials of a cold w

"Well spoken, young man. Well spoken!" approved the stranger as he walked away.

It is not surprising that this conversation added greatly to Luther Burbank's confidence. He had stated some important principles which he had never before put into words. This stranger encouraged him to put his thoughts, his dreams into words and to make a pledge to himself.

Now that he had said these things they seemed more important than ever to him. Hardiness was to be his basic principle of plant creation. And hardiness remained his basic principle as long as he lived.

7 LUTHER DOES THE IMPOSSIBLE

Upon Luther Burbank's arrival in Santa Rosa, California, there was no one at the train to meet him. No one in Santa Rosa knew that he was coming.

Having very little money Luther first had to get work to support himself. About the only employment which seemed to be available was the driving of teams of oxen or mules which pulled the heavy plows used to prepare the soil for wheat. But Luther was not a rugged young man, since the time when he was overcome by the heat when he ran three miles to help save his father's timber from fire he had not been able to stand heavy work in the sun.

He walked alone through the few streets of the little village. At that time Santa Rosa did not have even a sidewalk. There were no vineyards, orchards, or ornamental trees. The town was surrounded by wheat fields. Luther observed an opportunity for a free night's lodging in a small building near the edge of town. It proved to be an unused chicken house. After dark, he went to this building, placed some hay from a haystack nearby on the floor and in this chicken coop he enjoyed his first night's rest in what he believed to be a country of opportunity. It was quiet in that abandoned chicken house on the edge of town, and he was happy. He had the satisfaction of being in a climate where his ambitions might be realized. He was just as sure that he was going to succeed as any one could be.

The next morning, he came to a place where a building was being constructed and applied for a job. The contractor told him that if he would furnish his own shingling hatchet he might come to work.

Luther went to a hardware store and spent his last dollar for a shingling hatchet. When he returned to

building, the contractor told him that another applicant had come ahead of him and that there would be no employment. An explanation of what Luther had done in spending his last dollar for the hatchet did not change the decision of the contractor. Fortunately though, Luther was able to get his dollar returned by the kind-hearted hardware merchant when he explained the situation.

There were very few days during the remaining months of the year 1875 on which Luther Burbank was sure that he would have enough money to pay for his next day's food. Such an experience would discourage most young men, but Luther kept his spirits high.

Every problem he said to himself, is merely a step toward success.

Each day he was able to get the necessary food, and finally in the fall of 1876, he secured more permanent employment from Mr W. H. Pepper of Petaluma, a town about thirteen miles from Santa Rosa.

Mr Pepper owned one of the few nurseries in California and Luther was happy because he was going to do the kind of work he liked. He worked in this nursery through the winter and into the following spring. Mr Pepper had a building known as a "hothouse" in which plants were started, and Luther was allowed to use a room above this hothouse as a place in which to sleep. But after a few months, this undesirable lodging and the hard work he had to carry on during the day in order to satisfy his employer caused Luther to become ill. He returned to Santa Rosa and went to the home of a friend who gave him the care and the fresh milk he needed during illness.

Through many trials of this sort, Luther did not appeal for financial aid to his brothers who lived in another town. In the first place he knew that they were having their own problems and in the second place, he was sure that they did not entirely approve of his plans. He could hear them saying to each other "Who

ever heard of such an insane idea as wasting your life working with weeds and plants which Nature herself ought to know how to handle!'

Even practical nurserymen did not applaud the ideas that Luther had for no one had ever made a living as a plant improver The creation of useful new plants as a life s work was an impossible venture, so far as practical men were concerned and they told the young man what they thought with plenty of emphasis.

They hoped that the plain facts would discourage him, and turn his thoughts to other employment. B t Luther was not to be discouraged. Past experience had taught him that, if you kn w what you want most you can get it if you persist, and plan and work, and keep up your courage. He had long before concluded that a man s saying that something is impossible does not necessarily make it an impossibility

"Such a statement, Luther had often said to himself simply means that the man making it does not know how to do what he says is impossible."

Luther had not yet been able to plant the experimental garden which he had drawn on the fly leaf of the book the day his train was stopped on the prairie. But h had taken the ten Burbank seedlings to the home of one of his brothers, and his brother had allowed him to plant them on a part of his land. These ten tubers produced a crop of potatoes in the fall which Luther retained to be planted for the next year s crop. After he harvested the second crop he began to sell the tubers to potato growers and this brought him a small income

The people of California had been accustomed to a red potato They were not easily persuaded that a white one could be as good, even though it was larger and yielded much more. A little at a time, however the popularity of this new vegetable grew in the

states, until in a few years it became the chief variety of potato grown there.

Luther was later able to get a small piece of land near Santa Rosa, and gradually he developed a small nursery from which he sold both potatoes and trees. He did the work in this nursery in his spare time, after spending the day at carpenter work. The day's work was harder because it was not nearly so interesting to him as his work with living things.

In those days California was not recognized as a fruit country as it is now For that reason, Luther's nursery business grew very slowly His first sale of fruit trees was in the year 1877 The careful accounts he kept of all he did, show that the income from the sale of nursery stock that year was $15 20 In 1878 his returns were $84 In 1879 his income from trees was $353 28 The next year he earned $702 The following year he sold $1 112 69 worth of fruit trees and flowers. He was making progress.

Such ability did this young man display in the selec- and growth of fruit trees that his income continued swell until, in 1887 he sold over sixteen thousand dollars worth of nursery stock.

One reason for this pleasing success was that Luther Burbank had demonstrated that he could do the impossible The first performance of what every local nursery man called an impossibility occurred in the year 1881

A Mr Dutton, a wealthy merchant and banker of Petaluma California, had developed a sudden interest in prune growing and wished to establish a large prune orchard quickly Mr Dutton who had met the young Santa Rosa nurseryman came to see him in March of 1881 He asked if Luther could furnish twenty thousand prune trees ready to set out the coming fall Other nursery men had said that growing prune trees in one season would be an impossibility In fact everyone knew that it could not be done—everyone but Luther Burbank.

Mr Dutton agreed to furnish what money was necessary to carry on the project during the summer and Luther agreed to produce the trees.

He had experimented as a boy in the grafting and budding of fruit trees. He knew that a tiny bud cut from a prune tree could be grafted onto the root stock of any other tree which belonged to the same genus.

He knew from experience, also that the seeds of almond trees sprout quickly and grow rapidly The almond is closely related to the prune So Luther concluded that he could produce twenty thousand prune trees in one summer if he were to transfer buds from prune trees to the trunks of fast-growing almond seedlings.

His experience in making sweet corn grow more rapidly was also knowledge on which he drew in this case He determined to care *for* the almond seeds in such a way that the roots would develop rapidly and quickly provide a trunk on which to graft the buds from th prune trees

Luther rented five acres in addition to the two acres he already had He secured enough men to help him plant the almond seeds and, as soon as the seedlings were ready to transplant them into rows in the nursery

He spread the almond seeds n well-drained bed of creek sand and covered them with coarse burlap cloth This, in turn was covered with sand about an inch deep. In this way he could lift up the burlap and examine the almond seeds without disturbing them.

The seeds sprouted quickly and as soon as any were ready they were transplanted. By the last of June, some of these new almond trees were ready to receive the prune tree buds. By the first of December the twenty thousand prune trees were delivered to his customer

According to what the older nurserymen !
Luther Burbank had accomplished the imposs'

Naturally Mr Dutton did not hesitate to tell all his friends about the young nurseryman who had produced prune trees in one season. Never before had a prune orchard been created in one year It is easy to understand therefore that Luther s good reputation spread, and his nursery business succeeded. It appeared that his ambition to devote his entire time to the production of new and better plants was soon to be realized

With the money he received for the prune trees Luther purchased four acres of land in the very heart of what is now the modern Santa Rosa.

It was a neglected piece of property which the owner had tried to sell for a number of years Everyone considered the land to be very poor No crop had grown on it for a long time But Luther had examined it carefully and concluded that it was just what he needed for his experimental work The land had been the bottom of a pond at one time and so it was rich soil. He had eighteen hundred loads of manure spread on the four acres. In this way Luther made a rich soil—the kind he knew he would need for the work he was now to follow in earnest

He first planted fruit trees on this land, and by the end of the second year he had sold enough of these trees to pay the cost of the four acres as well as to pay the workmen.

He now had the land ready and there were no debts to be paid In a few years, this four-acre plot was to support more new plants, and a greater variety of strange plants, than ever grew on four acres anywhere in the world

He had also earned enough by this time to buy a farm at Sebastopol seven miles away on which the soil and conditions were more favorable for the growing of fruit trees and certain other plants.

The selling of new varieties of plants is not like the selling of nursery stock. However the satisfaction to an ambitious young man like Luther Burbank is far

greater He knew that for at least several years he might not have as big an income from the selling of new varieties as he had from the selling of nursery plants. So he continued with his nursery work as part of his project for three or four years.

The year 1885 marked the beginning of his specializing as a plant inventor He had at last, at the age of thirty-six reached the point at which he could devote his entire time to doing what he had set out to do

There was a time, when Luther Burbank, as a small boy went to a theater with his father and there saw a magician change a black cloth into a white one. The magician rolled a large piece of paper into a tube pushed the black cloth into one end with his wand and the cloth soon came out of the other end perfectly white. The magician then unrolled the paper and the audience was satisfied that the black cloth had turned white

After Luther became a successful plant improver in California, he started to work on the blackberry with the idea of making it white But this trick could not be performed in as short a time as the trick of the magician he had seen in Massachusetts

As a matter of fact the two tricks are entirely different The magician had not actually changed the black cloth into a white one He had a piece of paper in which there was a paper pocket. The black cloth was pushed into this pocket after the paper had been rolled and a white cloth was pulled out of another pocket at the other end of the cylinder The audience did not see these pockets. So after all what the magician had done was to create an illusion. The people *thought* they saw a black cloth turn into a white one actually there was no change whatever

Mr Burbank's job was to make a blackberry really white and he could not do it by trickery The berry must be white, not only in his garden but wherever the plants grew

The magician changed black to white to entertain his audience The plant improver proposed to change black to white to make blackberries more delicious, more palatable and more interesting In short, his job was something more than just to change the color Far more, in fact, for he must at the same time change the flavor the

size the productiveness and he also wanted to make an earlier bearing blackberry bush.

Hearing of a wild blackberry growing in New Jersey which was said to be white Mr Burbank had some of the small bushes sent to him But the berries were small and not good to eat. Furthermore, they were not white. They were a yellowish brown However they were not black and Mr Burbank thought he might use these plants in creating what he wanted.

So he crossed them with the best of the black black berries which he had. His favorite for this purpose was the Lawton. He liked its flavor and it was a popular berry Everyone who grew it liked it but Luthe Burbank felt it could be improved. The berries were not so large as they might be, and they were jet black.

With the seeds from this first crossing, work was only begun. Not one of the seedlings bore white berries all were black. But he transferred the pollen from these seedlings to the flowers of the wild blackberry and crossed the pollen from the wild one with the seedlings. In the next generation, he found some bushes whose canes were a lighter color When the cane of the bush is a light color there is some likelihood that the fruit may be light also. So he was encouraged.

When you are working with Nature, you may xpect many curious things to happen. One of the seedlings from the first cross had an unexpected characteristic It bore black berries, but it continued to bear both flowers and fruit the year around. Also it continued to grow in height. By the time it was three years old, the top could not be reached without a stepladder However the berries were small and showed no signs of whiteness It was only a novelty but an interesting one, for it showed what strange things may come as a result of crossing

When the lighter-colored bushes of the second generation bore fruit, this fruit was also a lighter color It was not white, but it might be described as a "yellowish white.

These bushes were selected for further tests. The pollen from their flowers was crossed with other seedlings, and the seeds thus produced were planted. Some of the new varieties which resulted from this last cross bore berries of a clear crystal white so colorless that the tiny seeds inside could be seen through the translucent pulp.

However there were only four or five bushes bearing these white berries, out of a total of several hundred. One of the white fruiting bushes was selected as best and when it was multiplied a white blackberry was available for the market.

The new berry which was named *Iceberg* had not only a clear crystal white color but bore large berries with a delicious flavor. There were a few thorns on the bushes because in this case the effort had been to produce a white berry rather than a thornless bush. The bush was prolific. It bore great quantities of these delightful berries. There was no tinge of yellow in any of them. Every little ball in each berry was pure white.

The work of producing this white blackberry occupied several years. And today while the white blackberry has not taken the place of the black one there are many people who enjoy the *Iceberg* blackberry for they can grow it in their gardens.

9. BERRIES WITHOUT THORNS

Like other people Luther Burbank was annoyed by the long hard thorns on blackberry bushes, which scratched him as they scratched anyone approaching a berry patch. So he set about remedying this situation. The nursery rhyme about the man so wondrous wise that he first scratched out his eyes in the bramble bush, then scratched them in again, might well have been written about this plant wizard.

Luther Burbank reasoned with other naturalists that plants developed thorns for their protection. But he thought, if we give plants their proper care they should have no need of thorns and so he set out confidently to disarm the blackberry

His work to get a thornless blackberry began in 1880. At that time he purchased a blackberry called the Wachusetts thornless, which had fewer thorns than other varieties It did have some and so was not truly a thornless blackberry However he used it as one of the parents in making crosses with thorny black berries.

Later on, he got another variety of berry which was known as the "wild dewberry" and which was also nearly thornless. The seed produced by crossing these nearly thornless berries with others, produced two or three new species which were almost without thorns.

Then these were crossed and among their offspring he found several more which were without thorns This was the second generation from the original crossing H then raised more than 15 000 seedlings from the seeds of the best of these thornless plants, and out f that large number none of the new varieties of the third generation had thorns. All of them were without any sharp points anywhere on the plan

But he considered that their fruits were not good enough to introduce.

The dewberry which was one of the parents he used, was a plant that trailed on the ground rather than stood upright To insure an upright shrub and at the same time a better fruit, Mr Burbank used the Lawton black berry pollen to cross with these new thornless kinds. He hoped by this method to secure a smooth bush which would bear delicious berries, and that is exactly what he found on his Sebastopol farm one day in 1911 more than thirty years after his first work with blackberries.

My own work in recording his experiments had just begun when one day he came rushing into my office and said Beaty at last I ve found it ! It s wonderful ! It s delicious ! It s the most superb flavor I have ever tasted ! After all of these years I finally have it !

But what is it Mr Burbank ? I urged. "Tell me what you have just found.

"A thornless blackberry " he said.

But, Mr Burbank, I reminded him "you have had hornless blackberries ever since I have been here.

Oh but those thornless bushes out here have fruits that are insipid, he said. "They are tasteless. They are worthless. The bushes have no thorns, but the fruits are not good. This morning I found the one I have been working for all these years.

Just to take the thorns off is not enough. The fruits must be better than any other blackberry fruit. And at last I have it ! There is one new variety near the fence at the west end of my Sebastopol place which I shall introduce. The stems on that plant are so smooth that you could rub them over the face of a baby without injuring it in the least. There isn t a sign of a thorn anywhere. And the bush is prolific. The berries are large and glistening. And the flavor is delicious Beaty I have it at last !

It was this enthusiasm which helped Mr Burbank to keep on working even after he had experienced the greatest disappointments.

This work with blackberries was interesting because it was necessary to cross back and forth between thornless and thorny bushes. Every alternate generation of seeds produced only bushes with thorns A characteristic in a plant which has existed for unknown generations is likely to be much more difficult to change.

People who saw Mr Burbank s new thornless black berry agreed with him that it was the most beautiful and the best-tasting blackberry they had ever seen The fruit was large and a glossy black it had an excellent flavor and the bushes bore in abundance

To produce blackberries with those characteristics he used the same simple method he had employed when first experimented with the oxeye daisies in his mother s garden in Massachusetts. He carried pollen from one flower to the other and planted any number of seeds, until he finally got the one ideal plant toward which he had been working

A STONELESS PLUM IS PRODUCED

The stage magician Luther Burbank had seen when he was a small boy could make a silver dollar disappear from a locked box. This trick came to his mind one day when he thought, 'What a splendid trick it would be if I could remove the stone from a plum without breaking the skin."

He reasoned th t in a commercial orchard the stone is not needed for th seeds are not to be used fo reproduction Nature had to provide the stone because with out the help of man the protection was needed to keep mold from the seed and to prevent decay until the time of sprouting However it requires a great deal of food and energy on the part of th plant to prod ce the shell, to protect each seed and this seemed to the thrifty magician to be a waste. He wanted to remove t

so that the tree might use all its energy for the production of fruit, seed and leaves.

One thing that stimulated him to attempt this apparently impossible feat was news frow France of a small wild plum which in itself, was absolutely worthless, but which had very little shell surrounding its seed In fact, the plum was called Sans noyau " which means without a seed covering He secured some plants of this wild plum but when he had grown the fruits, he discovered that there was a rim of stone more than halfway around the seed kernel.

The fruit itself was no larger than a cranberry and was not good to eat. Nevertheless, he thought he saw a value in partial stonelessness because he knew that if he crossed the pollen from this species with blossoms of good plum trees he would likely produce new plums which would have almost no tone

Crosses were made between this wild plum and several cultivated varieties. At first the fruits were of no practical value xcept that many of them were stoneless. Each had a seed of course but the seed was not protected by a stone. Therefore, Mr Burbank made further crosses, and this crossing of hybrids on hybrids was kept up until success finally crowned his efforts

His first crossing was with the French prune. The prune, it must be understood is a plum which can be dried for future use. In other words, all prunes are plums, but not all plums are prunes, for many plums crack when they dry and become useless as human food As a matter of fact, the skin of the prune must crack very slightly also in order to allow for the evaporation of the moisture

Many of our good prunes are delicious when used as plums and they are shipped from the fruit sections to the larger cities where they are sold as plums. But the remainder in the commercial orchard may be dried in the sun and later shipped as dried prunes

Mr Burbank often remarked that the removal of

spines or the removal of a stone is comparatively easy The difficult part was to produce a stoneless fruit which was of delicious flavor and large size and which grew on a tree desirable in every way for commercial growing Also, it must have the shipping qualities so necessary to enable it to be transported from the fruit section to the large cities where it is needed.

Stonelessness therefore was fairly simple to get in the early generations of these crosses, but good quality of fruit was not found until after about ten generations

The first of the stoneless plum introduced by Mr Burbank was named *The Miracle*. This was sold to the Oregon Nursery Company in 1903 In 1011 the first stoneless prune was introduced by him under the name of *Conquest*. This was a much more desirable plum than the *Miracle*, for not only could it be shipped as a plum but it could be dried as a prune.

One of its parents was the French prune and in the French prune about five per cent of th total bulk is made up of the stone The *Conquest* was as good as o better than the French prune and not more than one-tenth of one per cent of the total weight was stone. The stone did not cover the seed, but there was very small semi-circular shell near the edge of the seed.

This new prune the *Conquest*, had a golden sweet flesh. It was borne on a tree which was a rapid growe and produced an unusual quantity f fruit. Well named, it marked one more conquest over difficulties by the plant improver

During bout forty years work Mr Burbank introduced sixty new plums. While a few of the first were seedlings which Nature herself had produced most of his introductions were created by crossing the pollen of one kind with another planting the seeds, and then selecting the best.

His crossings produced new fruits of the widest variety Some would be one color some another

were absolutely worthless but a few gave promise of being better than any formerly produced. These of course, were tested further and those which developed no bad characteristics were grown in larger quantities in order to give Nature an opportunity to bring out any weaknesses which might make the plums undesirable.

After these plum experiments were under way Mr Burbank usually had about thirty thousand new varieties coming into bearing each year More will be told about them in later chapters, and a partial list of the Burbank plums will be found at the back of the book.

10. HOW THE MAGIC WAS PERFORMED

By helping compile notes and set down records of experiments it was possible for me to gain a clear idea of Luther Burbank's working methods and he himself learly recalled the effort behind every success Once he stopped in the midst of the description of one experiment, and said, "No no you make that seem too easy It was hard work!"

When people read of the almost unbelievable success of a great man, they are often inclined to think that this success came in some mysterious way It is seldom that they realize how slowly and laboriously it was built

Mr Burbank did not consider himself a genius. He did not believe that he was the only one who had the formula for creating new plants that it was impossible for others to carry on in the same way But he could not forget the years of disappointments, the days of crawling between plant rows on hands and knees, the nights of making records.

Sometimes, when I watched Mr Burbank at work, it seemed to me that his senses were more highly developed than my own. He seemed to be ble to recognize a shade of color that I could not see his sense of taste was better educated than mine When I commented on this, his answer was prompt

"I doubt that my senses to begin with, were any different from those of others. But it may be that, because I use my sense of taste my sense of smell, and my sense of sight more than most people for distinguishing slight variations, my senses n w react more quickly

"We are standing," he went on, " t the edge of acre of land on whi h I once found a sweet-smelling r

It may be that my experience in this case will help to answer your question.'

Then he told me the story of an earlier experiment which illustrates his way of working and explains how the amazing results were obtained

Those who saw Luther Burbank as the fortunate recipient of world honours might find it hard to beleive that he would spend hours crawling on his hands and knees through an acre of callas to smell of each blossom. Yet he did that very thing—and it brought him fame

He had long wished to produce a calla with a sweet scent. He loved the graceful form and the color of the white flower but the odor of those previously in existence was unpleasant.

"If, he thought to himself many times, "I could retain this beautiful form and color and add fragrance agreeable to man I could contribute a great deal to the pleasure of human beings.

With that thought in mind, he set about to produce such a flower Of course, he was looking for other improvements as well, but a sweet-smelling calla was his chief objective.

At length he had an acre in which there were many blossoms larger than those of the parents from which the new varieties had been developed There were some with tiny blossoms, but so perfect in form that because of their small size they were much more attractive than some of the larger ones.

There were white blossoms and yellow blossoms. There were pleasing blossoms and those that were not pleasant to look at. But the odor from all the blossoms was disagreeable it was the common odor of the calla.

Day after day he had walked through this acre without discovering any other odor But one evening as he approached the field he detected a pleasant scent which stood out above the other less agreeable odors.

He walked down the first row and, as he walked he was sure that his nose had not deceived him. At last he had a sweet-scented calla! But in that acre, there were certainly ten thousand new varieties, or more. The question was, which was the sweet-smelling blossom! He walked here and there but could not determine where the pleasing fragrance might be located. Yet he could smell it, no matter to what part of the acre he went, and that was satisfying because here was a pleasant scent strong enough to stand out above ten thousand bad smelling flowers.

He knew that he could not afford to put off finding that flower even for one day· on the following day the fragrance might not be so easily recognized He knew that there was no way to find it except by the use of his nose

So he got down on his hands and knees, started at one corner of the field and smelled every blossom until he found the one he wanted. It was not the second or third or even the fifteenth or fiftieth blossom He had to work until long after dark, and probably smelled three or four thousand blossoms before he finally found the one which was sending out its message of good will to mankind. Then, thankfully he marked the plant by tearing off a white strip from his handkerchief and tying it around the stalk.

He named it *Fragrance calla* and began plans for multiplying it so that it might be further tested and later introd oed.

This early triumph was one of the plants which helped to make the fame of Luther Burbank—a fame which spread not only over all of the United States but over all of the world. Great scientists from everywhere came to Santa Rosa to see him and to learn of his methods So we may say with some truth that Luther Burbank crawled on his knees to fame.

When Luther Burbank as a boy built ;
mechanical, he worked with only one unit. But

this same young man started to work with flowers, he then had to work with thousands.

There is no end to Nature s ability to produce variations. However never was he able to tell, even after he had years of experience just when Nature would produce the new plant he wanted The more seedlings he grew the shorter was likely to be the time it would take to find the improvement he was looking for As a matter of fact, there were many experiments which did not result in any desirable new plant. But, in every case he progressed faster if he used thousands of seedling, rather than two or three

The nine steps in his plan for producing new kinds of plants were

First he carried the pollen from one flower to anothers. This process was not limited to two flowers only He made the crossing with so many blossoms that, usually he had thousands of seeds as a result. The plants which were crossed in this way were carefully marked and records made of the crossing

Second he harvested the seeds from these plants and cleaned them carefully so that there would be nothing but seeds capable of producing new varieties in the pan when the cleaning had been finished

Third he planted these seeds in shallow boxes called 'flats.

Fourth he watched these flats and as soon as the new plants began to show themselves above the surface he studied each one Those who have never seen a quantity of new plant creations coming above the ground may not realize how surprisingly different they are. Some grow many times faster than others. Some have undesirable characteristics which can be recognized at once

Fifth, the minute he discovered anything undesirable, Mr Burbank destroyed those plants which showed the undesirable characteristics. Thus many were destroyed before the plants were transplanted from the flats.

Sixth after all had been eliminated except those which showed no fault the remaining plants were transplanted into test beds. There they were given more room and the best of care. Every day he examined each bed.

Seventh if anything could be found to criticize it was enough to doom the new plant after it was transplanted. Some plants in the test beds appeared to be more easily injured by insects or the weather than others they were immediately destroyed. Some were there which gave off unpleasant odors, or developed colors that were not pleasing

From day to day therefore, the number of plants in an experiment decreased. While the improver started with thousands. he wasted no space by growing those which promised to be worthless.

Eighth th best of the new plants were crossed the seeds from the best were saved and other thousand of plants resulted—often millions were used in one experi ment.

Ninth, in the case of tree fruits, it was necessary to go through another process which could not be used with the flowers As soon as a new fruit tree had grown from seed to be tall enough to allow the removal of a tiny bud or twig, the twig or bud was cut ff and grafted on an older tree Usually this new variety then bore fruit the following year or at least the second year

If Mr Burbank had waited until the original seedling had produced fruits of its own, he would often have waited six or seven years or more But by grafting on an older tree, he obtained the fruit sooner

Meanwhile the little tree which grew from the seed was allowed to continue to grow and was kept carefully marked for only from this tree could additional cions be obtained fo th reproduction f the new kind if it was to be introduced. Of course a few ci ons might be btained from the tiny branch which was grafted on the test tree but the original tree was the one commonly used.

This brief review of the work is likely to make it appear that it was quite simple and easy because reading of methods and results takes only a few minutes. But to produce one new variety worthy of introduction required years of painstaking toil Thousands of seedlings were destroyed for every one that proved to be useful

For example, the routine of producing a new plum started with individual trees brought from Europe Asia, and the east coast of America most Burbank plums have this ancestry As the blossoms of these three trees opened, Mr Burbank early in the morning before the bees started to work picked the flower from one and scattered its pollen on the pistils of flowers on one of the other trees A record was made, a label placed on the stem on which the fertilized blossom grew and when the fruit ripened in the fall it was picked carefully marked and the seeds preserved until ready to plant

Then the seeds were planted in a special soil mixture hich he had discovered, brought about quick growth plant magician studied the tiny trees as they came above the ground and thrust their first leaves upward into the sunlight. Over a period of years he had noted the characteristics of the leaves and the stems of the trees as compared to the fruit, and he could often tell what kind of fruit a tree would bear when he saw the developing seedling.

As with other plants, the new plum seedlings were examined for undesirable characteristics Thorns doomed them to the bonfire. Mr Burbank passed the growing plum seedlings almost every day and whenever he saw one which was undesirable for any reason whatever he consigned it to destruction. Nature would have eliminated it eventually but he could help Nature and save space by eliminating it more quickly

As those which gave some promise of future value grew larger they were transplanted so that they would have more room in which to grow Again the weeding

out of the undesirable ones was a prominent part of the work

After the cion was grafted on the older tree he watched the cion more than the tree itself If he saw any indication of weakness in the bark, leaves, or fruit, the cion was cut off and some other one grafted where it had been "There is no place in my orchard for loafers, he often said

The host trees were planted about three feet apart in the rows, and the rows were about five feet apart. By planting trees close together he was able to get more on an acre This again illustrates his desire to make the utmost use of everything, which perhaps was based upon his New England instinct for practical thrift.

Mr Burbank's fruiting test plots occupied about three acres on the Sebastopol place As he walked between th rows, he looked at every fruit, at every cion If a fruit was ripe he tasted it. If the fruit was cracked, he tied a piece of Manila twine around the stem on which it grew This was the death warrant.

If on the other hand, the fruit appeared to be as nearly perfect as he wanted it, and if it had desirable taste he tied a little strip of white cloth around the stem to indicate that this new variety must be preserved If he was undecided, he did not mark the branch at all but waited until it fruited another year

Day after day during the fruiting season he went through his plum orchard because there was something new waiting for his inspection every day Yet hours of walking and careful observation often resulted in the discovery of not one new plum which was worthy

When a plum was marked with a strip of white cloth, he looked up its record and located the original tree from which the cion was taken He cut more cions from this tree and grafted them on th trunks of seedling wild plums to make additional trees which would bear only the new variety Wild plum roots are likely to be more

hardy than those of other varieties, so they are best for root stocks.

It was only in this way that more trees of this one new variety could be obtained No other seed ever planted or ever to be planted could produce a plum exactly like the one selected grafting was the only way to get additional trees for commercial orchard tests This applies to plums, apples, pears cherries, quinces, and other orchard trees.

If the seedling selected had enough branches on it to make twenty five trees of the new variety these trees were then grown under conditions which compared to a commercial orchard They were allowed to come into *bearing, and further tests were made to make sure that* the fruit wa all that was expected

If anything then developed which made the fruit undesirable all f the trees were destroyed and the fact that thousands f dollars worth of such plants were destroyed each year shows that there were many many such disappointments.

In some cases, Mr Burbank had a fruit ready for introduction five years after the seed was first planted But it was more likely to be ten years or longer Some of his best introductions were produced not from the first crossing of pollen *nor from the third fourth fifth, sixth* seventh or ven the tenth—but from the twentieth or fiftieth cross. That is one of the reasons why he worked with thousands. If he had worked with only one seed at a time he would never have accomplished very much By working with thousands of seeds at least one was likely to turn out to be of some value although ven that was not assured

Many have wondered how we obtained our fruits before Mr Burbank created new varieties. From the beginning of time Nature has been a plant improver Nature has crossed the pollen. She has the bees and other insects to do that work. She has made her crosses grown the seeds destroyed those which were not suited to their environment and allowed those to grow which were

worthy However Nature always required a much lo ger time when she worked alone than when Mr Burbank helped her One of his greatest contributions to Nature s creative laboratory was to speed up the process.

AT WORK ON A GRAND SCALE

Most of the magicians we see on the stage perform tricks which have been invented by others They may vary the performance somewhat from the originator' technique, but the principles are the same However a good magician will in addition to this, have some tricks which he has originated himself. The plant magician operated in somewhat the same way

Luther Burbank never claimed to have originated the trick of producing new varieties of plants. He knew that Nature had invented the method he used long before man knew anything about t and he often said that the basis of his work was Nature s method of plant improvement discovered by Charles Darwin and described in some of that scientist s early books.

He secured seedling plants wherever he could find them. If Nature herself had made the necessary crosses to produce variations and if a seedling from these crosses turned out to be worthy of introduction Mr Burbank did not hesitate to introduce it after all, it was as much his discovery as if he had made the original cross. For the most important part of a plant creato s work is the selection of those varieties whi h are worthy of introduction to the general trade It requires the greatest knowledge, the keenest development of senses, and a willing ness to destroy all plants except those which are far better than any thers in existence.

Such perfection did Mr Burbank reach in the grafting of seedlings that he had as many as thirty thousand new varieties come into bearing each year He grafted many new varieties on one older tree each branch of th older tree was able to support a cion from a seedling Thus he might have as many new kinds of fruits growing on a tr as there were branches.

No one before his time had developed this method of speeding up the completion of Nature's efforts to create new varieties But Mr Burbank wished to create as many new varieties as possible as soon as possible. He saved time for himself and Nature by using all the shortcuts he could discover

No doubt one of the most important principles was that which required destruction of the useless plants Mr Burbank had a space on the Sebastopol farm to which he carried all of the plants which were to be destroyed. There h accumulated a huge pile and once a year set fire to these worthless creations He called it his ten thousand-dollar bonfire because he estimated that it had cost not less than that to produce the fuel which went up in smoke in an hour

Those who saw the size of this bonfire often agreed that this estimated value was probably much too low The important thing about the bonfire however must be emphasized again. That is, Luther Burbank was willing to destroy promptly any creation no matter how interesting which he was sure would be less valuable to man than what man already had

Many are so proud of what they produce that they are never willing to destroy any part of it, even though it will never be of service But in order to work with thousands, Mr Burbank had to have room. He had to have time. And if he had left these worthless plants where they grew they would have occupied room and consumed time An important part of his philosophy of life which made him the great man that he was was simply this "Time cannot be added to a person's life but it can be made more valuable by avoiding waste."

SELLING NEW CREATIONS

When he had twenty five trees of the new variety ready for introduction his work was still not finished He must find someone who would buy this new product

to fruit growers who would produce thousands of tons of fruit for man s use.

If Mr Burbank had not developed this part of his work as successfully as he did he might never have been known as the world s greatest plant improver He had to be a salesman—even the proverbial better mouse-trap has to be sold Even though he produced the best plums that had ever been grown the world would benefit very little unless he sold them to distributors, for he was no longer in the nursery business.

One of his methods of selling to nurserymen was to publish a list of his new creations and offer them for sale. In the catalog each new fruit was described in such a way as to make the nurserymen want to see it. Many of them visited Santa Rosa and Sebastopol and went away with purchases.

The price of these new creations varied a great deal. One new kind of plum which was named *Splendor* was sold to the Stark Brothers Nursery Company of Louisiana, Missouri, for $3 000 For this $3 000 Stark Brothers received the original seedling and th additional trees which M Burbank had himself grafted together with th right to introduce this new plum to fruit growers. Mr Burbank did not retain any tree of this new kind but left the distribution entirely to the purchaser

Stark Brothers purchased many other of his fruit trees and listed seventeen varieties of Burbank plums in the 1941 catalog. It is apparent from the listings of this one firm sixteen years after his death, that his plums are still popular among commercial fruit growers.

An idea of the large size of many of Mr Burbank s plums may be had from the description of one variety in the Stark Brothers catalog This is Mr Burbank' "Elephant Heart, and Stark Brothers call it 'the most marvelous plum ever fruited since the world began "

The catalog says This plum verily seems too good to be true. Even true you have held one of

hese huge blood red fruits in your hand, reveled n its exquisite lusciousness you eagerly reach for another and find yourself ecstatically wondering Can this actually be a plum ? It is a crowning quality triumph of Burbank's lifetime endeavor to develop finer fruits for mankind.

"The Elephant Heart is freestone blood fleshed plum The individual fruits often measure two and a half inches long by two and a quarter inches thick. They are as big as a United States standard apple They are dark red and pear-shaped in form They are easily broken open and the seed drops out of its own weight. This makes it easy to eat.

"Its other characteristics are It is remarkable shipper it is wonderfully hardy because it withstands the coldest weather the fruit hangs long on the tree."

Catalog descriptions are proverblally glowing with ight promise but unlike the illusive patter of the stage gician, the promises of the plant magician were put the test in bright sunlight, in home gardens and com mercial nurseries, and there was never any dispute as to the 'triumph of Burbank s lifetime endeavor to develop finer fruits for mankind.

Usefulness to mankind continued to be the guiding idea in all Luther Burbank s work, and this explains some of his preferences as well as his methods. It would appear from the fact that he did not introduce as many new roses as plums, for example that he did not care so much for the roses. As a matter of fact, he often admitted that he really enjoyed working with the trees more than with the smaller plants. Somehow the practical value of the food produced by the trees seemed to appeal to his New England thriftiness, and while he fully realized the importance of beauty in developing our characters and creating inspiration for our daily lives, he devoted more time and more space in his garden to food plants.

11. FIVE NEW PLANTS BUILD A HOUSE

Those who travel through the deserts of south western United States see many cactus plants. They grow far apart. And they grow slowly

At least, they did until Luther Burbank took an interest in their value as food for livestock. In his conversations with ranchmen who lived in the cactus country he learned that when a fire had burned the spines from a cactus plant without seriously damaging the plant itself, animals were seen to eat the cactus with great relish. Containing about ninety-eight per cent water the most vital of all animal needs on the desert, a cactus plant supplies both food and drink to hungry cows

After learning that livestock would eat the cactus when the spines were burned off some of the ran hmen made a practice in dry seasons of burning off these spines with torches. But this was such a tremendous job that it was not practical except in cases of the greatest emergency

Luther Burbank determined that a worthy ffort of his should be to prod ce a cactus without spines. More impor tant he wanted one which would grow more rapidly—a thousand times more rapidly—than those wild varieties which inhabit the southwestern sections where rain comes only two or three times a year

When Luther was a very small child his most loved toys were plants. Among the many kinds of plants which he frequently carried around, as othe children carry toys, was a cactus which had no spines. He now recalled this plant, and as he studied further he learned of some wild cacti which grow without thorns. But all cacti, up to that time, were slow growers. No practical crop could be grown with the varieties then existing

The reason the cacti grow far apart on the desert is that each one must have a wide area of soil from

to absorb moisture when the rains do come in the spring. Because of the ability of the roots to take up moisture rapidly and because of the design of the plant's stem moisture can be retained the cactus has a skin which does not allow much moisture to evaporate, and it has storage cells inside. Thus the cactus can often live for three years even though no rain comes.

Concentrating on the cactus problem Luther Burbank took into consideration those arid sections where water for irrigation could be obtained from near by rivers, and also the semi-arid places having more rainfall than the deserts. It seemed to him that a fast-growing, spineless cactus could be used where some water was obtainable.

Also he learned of other parts of the world where such a forage plant would be welcomed He discovered that the great deserts of Australia are capable of growing the cactus and ranchers of Australia said they would like to have a forage crop of this sort so that they might raise more sheep.

He proceeded to work for such an unheard-of plant in the same way he had worked for other products. Crossing the pollen from one plant to another he used as parents both the spiny and spineless varieties. After studying the various kinds of cacti he decided to work with that kind which is known as *Opuntia*.

The stem of the *Opuntia* cactus grows in sections. The *Opunt as* which he believed would be most useful are those whose sections are wide and flat. People who see a new section growing from the stem usually refer to it as a leaf. As a matter of fact, it is not a leaf, but a section of the stem

What are now spines may once have been leaves with a broader surface However the cactus does not now digest food in its leaves, as is the habit of most plants but in its stems Each slab of the Opuntia has chlorophyl in the outer surface and this chlorophyl makes food from water and the carbon dioxide of the air in the same way that chlorophyl in leaves does a similar job

Luther Burbank planted flat after flat in his greenhouse with hundreds of seeds resulting from the crosses he had made As soon as a tiny cactus plant showed its head above the surface of the soil, he began to study it and make selections of those which promised to help him get what he hoped for From the first, he worked to produce a fast-growing cactus without spines. In the end he produced not one variety or two, or ten but thirty-five The cactus proved to be the most responsive of all the plants with which he worked.

My own experience with Mr Burbank began while he was working on his cactus experiment, and I saw him go through every step in the process which produced results more astonishing than anything else he did.

If you want to see me pollenize cactus, he said to me one afternoon, "come into the garden where the cacti are beginning to bloom.

He selected the blossoms of a cactus which was small and full of thorns. It was just opening its petals. The stamens were opening and were ready to shed their yellow life-giving pollen.

He pulled a thick leather glove n his right hand and held the blossom with this glove so that the many tiny little spines would not get into his fingers. Then with a long knife, he cut the blossom from its stem.

"It took me a long time to learn to do it tl is way he explained. At first I was so impatient to get result that I didn t bother with a leather glove. I picked up the blossoms in my bare hands, and many a day have I suffered from making that mistake.

He carried this amputated blossom to a cactus plant which was the result of previous experiments There he turned the blossom upside down and rubbed its stamens on th pistils of the other flower which was just opening.

This is the way I do it, he said. 'Some scientists would throw up their hands in horror if they saw doing it in such

experiment with cross pollination cover the plant the day before with a paper bag Then, the next day they carefully pick the pollen from one flower with tweezers and carry it to another flower that was previously covered with a paper bag

"That's all nonsense as far as I am concerned. It is a lot better to get here before the bees start to work. Then you don t have to bother with paper bags and tweezers The only thing that is necessary is to get the pollen to the pistil before any other pollen has reached it.

Pollen starts to grow as soon as it touches the pistil It goes down that long stem of the pistil and joins with the ovules inside the seed case. Afte it has started to grow no other pollen can replace it So there is no reason to cover the flower after pollen has been put on it. No matter how many bees come they can t change this combination I have just made

Mr Burbank then wrote in a book the date the ·s, and the locations of the two plants which he had t used as parents for seeds which would produce new varieties.

Later on in the season the fruits which are commonly called prickly pears, were ready to harvest. When we cut them open we found many seeds inside. These seeds were carefully dried in a pan that was labelled, so that there was no question as to what plant they came from and what plant had furnished the pollen The records of all of this work were kept in permanent books, which Mr Burbank guarded carefully

After the seeds were ready for planting he planted the seeds from one fruit in a flat. The flats were kept in a greenhouse until the seed had germinated and the young plants were thrifty enough to be taken out of doors.

Each morning Mr Burbank and I went to the green house and examined all the flats. This one whose story we are telling showed a young plant thrusting its head

above the surface in just a few days. I kept a careful *record of my own* and each day discovered more plants. That is, I counted the number of plants each morning and found a larger number every time we examined the flat. But some of these new plants did not come above the surface until many days after the first one had shown its head. In other words, some were slow to start, others quick. Some were slow in growth others grew fast.

After all the plants had a sufficient start in the green house Mr Burbank took the flat out of doors and put it in a hotbed where glass windows could be placed over the top when he thought necessary

In a short time there were two cactus plants in one flat which were growing so much faster than all of the rest that Mr Burbank thought it wise to transplant them so the others would have a better chance. H transplanted them into a bed and, again, he made careful records as to the parentage

Only one of these fast-growers was without thorns. Nevertheless, he kept them both, in the hope that the thorny on would show characteristics which would be important to his work Selections f transplanting continued for several weeks until the original flat was empty

In the meantim many f the new varieties whi h came out of this flat were destroyed. All of those which grew very slowly and some which grew fairly rapidly but were covered with thorns were thrown away

It was not only th top p rt of the cactus which Mr Burbank examined when he was discarding those which he believed were worthless He examined the roots also To grow rapidly any plant must have a good set of roots. Roots f the *Opuntia* cactus usually are not so large b t there re many of them, and they grow long distances. As a matter of fact, a thousand small roots will gather much more moisture than one root as big around as the thousand put together The surface f the root containing the root hairs, is what gathers the ture.

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Search for weak characteristics continued as long as Mr Burbank observed the new varieties. This job of selection is so important that many people have failed at this point It is quite a simple matter to produce new varieties, but it requires real ability to *select* new varieties which are worthy of introduction This ability is developed only by experience and study

There were at length, only three plants remaining from the seeds picked from the fruit which I saw Mr Burbank pollenize. Two of them had no spines. These two were growing much more rapidly than the one with spines, although the spiny one grew at least a hundred times as fast as its wild ancestors. That is why Mr Burbank saved it it might be useful as a parent for further experiments

The other two without spines had become large enough to propagate Before a new plant is sold a quantity of plants all equally good, must be shown to the buyer in order to demonstrate that the plants will reproduce themselves with sufficient accuracy to make them of practical use So it is necessary with these new varieties of cacti to grow fifty or a hundred plants to demonstrate what others can do when they wish to plant a whole field

The propagation of various kinds of plants is carried out in different ways. An annual plant is reproduced by its seeds. The potato is propagated by cutting its tubers into pieces and planting them A plant like the dahlia is reproduced by separating its tubers and planting them

The Opuntia cactus is propagated by breaking off slabs and thrusting one end into the ground. The common way is to dig a little trench so that the portion of the slab which was attached to the plant will be buried in the ground three or four inches—just deep enough to hold it upright. This slab will grow more slabs from several of the many eye spots which cover its surface

So Mr Burbank and I broke off a dozen slabs from each of the two new plants and carefully placed them in

trenches. Those taken from each of the two plants were labeled and records were made in the record book. In just a few days, each of these slabs sent out tiny sprouts from the sides and from the top edge. In a few weeks, we had a dozen large cactus plants in each of the two rows.

Mr Burbank measured the area planted to some of these fast-growing cactus plants and, at the end of twelve months, he weighed every slab that had been removed from the measured area. Then he had an actual record of the amount of forage produced by each of the two new varieties of spineless cactus.

One of these new varieties on a measured piece of land produced the equal of ninety tons of forage per acre A farmer who harvests four tons of alfalfa is well pleased with the returns from an acre of land for a season s use. But a farmer who can harvest ninety tons of cactus per acre may well be the envy of his neighbors He is in a position to make more money from his farming becaus the cost f feed is tremendously reduced

The other variety when tested, produced ninety-eight tons f forage per acre. But these were not the most prolific of Mr Burbank s new varieties. He eventually produced one cactus which yielded at the rate of one hundred and fifty tons per acre in the third season after the original planting of the slabs.

The cactus plant is a perennial. That is, it continues to grow year after year without being replanted The only work in raising cactus is to cultivate between the rows and harvest th slabs, which are tender and as suc culent as grass. Their ninety-eight per cent of moisture has been converted into valuable food in the green slabs and is worth far more than ordinary water as nutriment.

It is not difficult to understand that such forage would be worth far more than alfalfa to those livestock raisers who live in dry areas where the cactus will thrive and where it can be irrigated. It is understandable then t

it could be possible to sell one slab of the new cactus for one thousand dollars.

Mr John M. Rutland of Australia, who bought the first five varieties of spineless cactus which Mr Burbank sold, paid one thousand dollars for one slab of the new fast-growi g plant. He paid almost as much for slabs of four other varieties. With the slabs, he bought the right to introduce these new kinds into the southern hemisphere

These five new varieties were named The Santa Rosa (the one for which Mr Rutland paid a thousand dollars) the Son ma (the name of the country in which Santa Rosa is located) the California, the Fresno and the Chico Later on Mr Burbank sold these same varieties for introduction in the northern hemisphere.

Let consider the apparently fabulous price paid by Mr Rutland of Australia, for five slabs of spineless cactus. Did he run any risk of losing these cacti by their failure to grow when they had finished their long trip halfway around the world ?

Of course Mr Burbank guaranteed that the cactus slabs would survive the trip to Australia or be replaced. He had made many tests which were much more trying than this trip halfway around the world. For example he had hung a slab of cactus from a rope tied to the limb of a tree where it had remained in the hot Cali fornia sunshine until it appeared to be thoroughly dry He took it down after many months, and planted it in the soil It immediately sent out roots and started to grow

When I arrived in Santa Rosa to work with Mr Bur bank, I was given a room in his old home, off which was a dark closet. One day as Mr Burbank and I were talking he asked Did you notice the slab of cactus in that closet?

"No I told him, "I have had no occasion to open the closet."

"Let's look at it now" suggested Mr Burbank. He pulled back the curtain which had covered the door and there on the floor lay a large cactus slab Upon it was growing a new slab which was fully ten inches long It was entirely in the dark. It had no source of moisture other than that stored in its own body It had no connection with the soil. Yet there it was growing under those circumstances. Mr Burbank told m that the cactus had been in this dark closet twelve months.

This is an illustration of the hardiness for which Mr Burbank always looked when he selected new plants. He would never interest himself in a plant which had to be pampered. It had to be able to withstand such vicissitudes as lack of food, lack of moisture cold weather dry weather disease, and destructive insects.

After Mr Rutland had been growing the spineless cactus for several years, he wrote to tell Mr Burbank that the new varieties were thriving splendidly in Australia. The cactus was valuable every year but in two different years of drouth, this fast-growing forage had made it possible for farmers to save the lives of thousands of sheep. Not only was he pleased with the results of his purchase, but he felt that the price paid was even less than the new varieties were worth.

With the four thousand dollars which Mr Burbank received for the five cactus slabs, he built himself a new home. Up to that time he had been living in a very small old house which was on his Santa Rosa land. He built his new home across the street.

In developing the spineless cactus, Nature outdid her self with Luther Burbank's help For besides feeding cows and sheep the plants provide an appetizing fruit for human food.

All the new spineless varieties produce fruits, and some of them were developed particularly for the value of their fruit. Prickly pear fruits may be bought in many cities today and some of them come from Burbank varieties of spineless cactus.

Not all the fruits however are entirely spineless. Most of them have little clusters of spicules which should be rubbed off with a heavy paper so that the fruits can be peeled Inside is a delicious juicy meat well filled with seeds. For a delightful breakfast dish, these fruits are cut into pieces about the size of a large strawberry and eaten like strawberries with sugar and cream They may also be cooked and made into preserves, jams, and jellies. Some housewives use them to supply a color to other fruit preserves, to ices, and to confections.

Burbank cactus slabs may also be used as food The tender slabs peeled and cut into slices, are fried in butter

The juice of the slabs is a splendid ingredient for candy

Many of the varieties developed especially for fruit produce tremendous quantities One slab contained forty three large red and yellow fruits

So prolific re some varieties of fruiting cactus that their produ tion is not measured in bushels per acre but in tons As much a one hundred tons of fruit have been harvested from an acre f one of these varieties after it had matured and w s producing its utmost in fruit each year No other fru t crop of any kind has ever produced such a quant ty

These figures are so unbelievable that it is not at all surprising that many horticulturists who never visited Mr Burbank s grounds, and so never saw the actual productivity of these plants, considered such statements false when they were first made.

However those who saw how close together these plants grow and how many slabs there are on a plant, and then counted as many as forty five and sometimes fifty large fruits on a slab could believe the weights given Mr Burbank weighed the fruits many times. He weighed them from measured areas and computed the total production per acre. He then published the figures in his twelve volume autobiography

The reason it is difficult for persons who have not seen a field of cactus to believe that there could be any such production is that their thoughts are based upon the spacing of trees in an orchard Burbank s cactus plants can be grown as close together as hills of corn and many varieties grow to be eight feet tall. The plant is literally covered with wide long thick slabs whi h bran h off near the gound and continue to branch out on all sides to the top of the plant. The fruits grow all over the surface of these slabs—not just on the end or around the edge Some of the individual fruits weigh as much as half a pound although the average weight is less.

Fruits of different varieties are of different colors white various shades of yellow green orange pink purple, crimson a vivid blood red and some are such a dark color that they are almost black The fl vors are difficult to describe In general, they do not taste like any other fruit. Most of them are slightly sweet. A few are slightly acid

The fruits of the wild cactus have been used in many countries for many years especially in seasons when other food are not available One summer Professor Lootsakos of the University of Athens Greece, told Mr Burbank that the wild fruits of the Opuntia are used by millions of people around the Mediterranean Sea for about three months of the year The Mediterranean peoples frequently soak the wild cactus fruits in sea water which they think improves the flavor Professor Lootsakos sai l tl at he preferred half a dozen good cactus fruits to the best beefsteak.

He was so pleased with the productivity of the new Burbank varieties, and with the size of the fruits that he asked the officials of his government to import some of the new kinds to improve the food crops for the people of Greece.

one producing the smaller peas. Thus, his company had varieties which were not available to competitors.

It should be emphasized again that this was all done without any crossing for there are many plants which can be improved this way Farmers have long known the value of selected seed, and when they pick their seed corn many take only ears of the type desired, from the type of stalk which the farmer likes best.

In this way corn has been developed to such an ideal state that the ears grow at just the right height on the stalk so that they may be easily grasped when they are being husked. Ears have been made to fill out all of the space on both ends, and have been selected to produce well filled kernels in straight rows which grow close together on the cob

While hybridizing is necessary with some kinds of plants, especially when characteristics of those which have grown far apart are to be combined a great deal of prac- work can be done by careful selection as Mr Burbank ...ted peas to fulfill his specific order Not only this ...rience, but all of his work demonstrated that plants ...an be made to order

WEEDS PRODUCE A NEW FRUIT

Since the time when Luther Burbank had experimented with weeds in the cow pastures of New England, he had believed that there are possibilities for improving plants which have become pests to the farmers. While he worked with many different kinds which never produced anything of value, he succeeded with weeds of the Nightshade family to which belongs the so-called deadly nightshade

It was because the tomato is related to the nightshade that people were afraid to eat the tomato fruits many years ago. As a matter of fact the potato belongs to the same family which also includes many weeds, two of which Mr Burbank finally persuaded to unite.

One of these weeds has the scientific name *Solanum guineense*. Its original home is in Africa. Another one is named *Solanum villosum* It came from Europe It was Mr Burbank's plan to make these weeds into a new plant which would be useful.

In addition to the fact that one of the weeds came from the southern hemisphere and one from the northern hemisphere before being transplanted to the western hemisphere the botanists classified them far part Mr Burbank experimented with them for years before he could produce a single cross. He carried pollen from one to the other but the blossoms thus pollinized did not produce seeds. However one of his most valuable characteristics was his ability to continue year after year regardless of discouragement; and finally in the season of 1905 his efforts were crowned with success.

He planted the seeds in his greenhouse and when the seedlings showed their leaves above the surface of the soil, he realized at once that he again had something entirely new although he could not tell whether the hybrids were of any value or not.

He transplanted them into the garden, and in time the new plants blossomed. One of them did not produce fruit, but the others bore fruit quite abundantly The fru it was not large and its flavor and other characteristics were entirely different from either parent It looked some what like a large blueberry and it had a pleasing flavor whereas both parents bore fruit with a flavor that could not easily be endured, and some plants of the family were poisonous.

Mr Burbank selected two of the best plants among the twenty which grew because they bore more fruit, th fruit was larger and the flavor was more pleasing The seeds of those hybrids were saved and they produced plants like the original seedlings when he raised two crops in one season in the mild climate f California. The fact that the plants reproduced themselves from seeds was complete evidence that he had an entirely new species.

knowledge of the relationships of certain plants. For example he had often wondered what would happen if he grafted a tomato plant on a potato plant. He knew that they belong to the same family group called *Solanaceae*. But the potato belongs to the genus *Solanum* whil the tomato belongs to the genus *Lycopersicum*. He thought they could be grafted but what the results might be he could not tell.

So cutting off the top of a tomato plant he grafted it on a potato plant. Then he cut the top of a potato plant and grafted it on a tomato root. In other words, he made the combination both ways. The results were astonishing

The new plant which was tomato above and potato below grew tomato fruits above—quite normal fruits, too—while potatoes developed underground. However the potatoes were not all normal. They were small twisted scabby and discolored.

On the other hand, the plant which was potato above and tomato below produced neither tomatoes nor potatoes. It is true that there were some strange growths on the potato plant above ground, but they were not potatoes, nor were they tomatoes.

In order to explain this surprising development, it is necessary to refer to the method of growth in plants

The roots of a plant take up moisture containing certain minerals which the plant needs. This moisture is sent up through the stem to the leaves. The leaves combine the moisture and its minerals with carbon dioxide which the leaves themselves take out of the air The chlorophyl in the leaf brings about the chemical change, for it is only chlorophyl which can take the power from the sun s rays to start the chemical laboratory in its production of food for the plant.

The food is carried to all parts of the plant, including the roots. And it is only on this food that any part of the plant can thrive.

It is easy to understand that the food must be different in different kinds of plants, for the result of the use of the food is quite varied. Therefore it would seem necessary for potato roots to have the food manufactured by potato leaves in order to develop tubers.

In Mr Burbank s test cases it is not surprising to find tomatoes on the plant which had tomato branches and leaves because the tomatoes received the right kind of food But the potato plant received tomato food, not potato food, and so the tubers were very much distorted.

On the other hand the plant which had the potato for a top could not produce potatoes underground because the plant did not send out the necessary underground stems, even though it received potato food. In the same way it would not be expected that the potato top should produce tomatoes, even though the root was a *tomato* root because the root supplies only the raw material and not the digested food. It is the digested food which gives the plant its character

Mr Burbank did n t find any difficulty in grafting the potato and tomato It is true that they do not have woody stems like trees but by using a long diagonal cut he made successful grafts. He placed the two cut portions tightly together and, to hold them in place tied twine tightly around them This, of course, was done quickly that is, the cuts were not exposed to the air for more than a few seconds Within a few days, the two portions grew together and the twine could be removed.

The essential feature in grafting is to connect the two portions of plants in such a way that the growing parts come together The growing parts quickly graft them selves to each other and produce tissues which give strength to the unit.

When trees are grafted a grafting wax is used to cover the wound until it heals. But when such plants as the tomato and potato are grafted wax is not at all neces sary Following this same technique, people who are

interested in the cactus have found it very easy to graft one kind of cactus on another The two grow together very readily

HALF A MILLION STRAWBERRIES—ONE GOOD

With 499,999 worthless plants as the result of several years of work, how could anyone keep on ? Most men would have quit—but not Luther Burbank. Ordinary folks would have weakened and offered one for sale which *nearly* met the standards—but not Luther Burbank

His high standards would not be abandoned even though he never found a good strawberry It was this firm adherence to these standards which made his good reputation He had determined when he was still a young man that he would keep his standards high—always !

There were 499,999 worthless ones and then came a prize. It was the best strawberry in the world. John Burroughs, the famous naturalist, said it was. He was so enthusiastic that he wrote eastern seedsmen advising them to purchase this variety which had been named the *Patagonia* strawberry Mr Burbank had let him eat a handful of the new variety and he knew that it would be enjoyed by everyone who ate it.

The berries are borne on a plant which grows vigorously and is admirably adapted to commercial planting Its foliage is dark green, thick, and thrifty The fruit grows in clusters which stand up from the ground. This is an advantage in commercial growing, because it prevents the berries from being splashed with mud during rainstorms. The fruit is no larger than some other varieties, but it is firm in texture, a bright crimson in color and it has a yellow flesh which sets it apart from all others whose flesh is white.

Furthermore, the *Patagonia* bears fruit throughout the summer It is called ever-bearing." Mr Burbank thought that this ever bearing quality was brought to it by one of its parents which came from Chile. Chile being in the southern hemisphere has its growing season ¢ our winter

When this plant was brought to the northern hemisphere where the seasons are reversed, it seemed to be confused and so continued to bloom and produce fruit throughout all of the months that were warm enough. This same characteristic had developed in apples which Mr Burbank brought from New Zealand and in rhubarb which also came from the southern hemisphere. Whether this is the true cause or not is difficult to say At any rate, it is an interesting speculation.

The strawberry has a wide distribution throughout the world. Some varieties grow in Patagonia, at the southern end of South America. Some grow in Alaska. Some grow in Norway where the seasons are very short and the winters very cold. It was quite natural that Mr Burbank should get varieties of strawberries from these far away places and combine them with others.

One of the American varieties used in his work was a plant which he had grown as a boy in Massachusetts. He developed a white strawberry from it, but this variety was not as productive as he felt it should be so it was not introduced

In addition to strawberries, he grew blueberries cranberries squaw berries buffalo berries, balloon berries, and a number of others. Out of these experiments, only two balloon berries were introduced

It is important to record these failures because they are representative of many many more which have not been mentioned and they indicate the difficulties which he encountered. However lack of results did not in the least discourage him. While he was experiencing many failures, he was having a few successes and these successes were profitable enough to support him in his work, and they gave him enough encouragement to keep him working toward his chosen goal.

Failures often make strong men Wise men are never afraid of failures. Usually they do not call the lack of results failures, but *interesting steps* toward success—steps which must be taken before the goal can be reached.

15. THE BATTLE OF THE FLOWERS

Warlike in name, the gladiolus is so called because its leaves suggest the *gladius* the sword of the Roman soldiers. Luther Burbank was very interested in this flower

This was the flower which, when grown in the Burbank testing ground, had to be defended with guns. Its enemies were the pocket gophers who helped themselves to gladiolus bulbs growing on Mr Burbank's Sebastopol farm. He was progressing nicely with the gladiolus when the gophers moved in. They work underground and it was a long time before the damage they were doing was discovered.

The pocket gopher is seldom seen on the surface It digs long tunnels, pushing the dirt out through openings here and there but staying well protected beneath it. The tunnels are seldom large enough to enable the little animal to turn around but the pocket gopher can run backward as easily as forward. It has a sensitive tail which feels the way when the gopher runs backward.

It was the appetite of this voracious little animal which caused the destruction of not less than ten thousand dollars worth of bulbs at Sebastopol. Ordinarily a pocket gopher eats the roots of trees grasses, and grains. But the new kinds of gladiolus bulbs which it f und in Mr Burbank s testing lot seemed to please it so much that it moved in with all its relations and systematically proceeded down one row after another devouring bulbs as it went

There were great numbers of these animals, and so tremendous was the damage that Mr Burbank had to give up his experiments with the gladiolus until he could get rid of the pocket gophers. This was not so easy He tried poison and gas, and traps. But none seemed to be effective.

He finally discovered an automatic gun which shot the gophers underground. It was called a gopher gun, and was so placed that the gopher would touch the trigger which discharged a load of powder These gopher guns killed thirty five or forty rodents every day and eventually the gladiolus bulb eaters were exterminated.

Mr Burbank had begun his experiments with the gladiolus in 1882 Most of the kinds then available were hybrids which had been created in Europe The gladiolus, of course reproduces its kind only by bulbs when seeds are planted new varieties are secured.

This beautiful flower originally came from South Africa and Mr Burbank early secured bulbs from its native home These he crossed with the European varieties At first the results of his work with the gladiolus were very disappointing The blossoms faded quickly in the warm California sun sometimes within an hour and the whole plant gave indication of not being thrifty For that reason his first efforts were to get stronger plants and blossoms which would withstand the sun s rays. He also selected for a more uniform arrangement of petals. The flowers of the early kinds were not at all symmetrical, and not so beautiful as those we have today It was a long time before he had new varieties which were pleasing to him

The first one introduced was named *California*. The blossom grew on a hardy plant, and had many extra petals, but the most important new feature in the *California* gladiolus was its great profusion of blossoms. They grew all around the flower stalk, almost as the blossoms of a hyacinth grow However the *California* gladiolus never reached the general public it was sold to an eastern dealer who through some carelessness, lost the entire lot of bulbs.

As soon as Luther Burbank had hardiness bred into his hybrids he began to select for flower arrangement on the stalks About the time he was beginning to have

good results, the pocket gophers moved in. His fight against these rodents lasted for several years. But after he felt that he had eliminated the danger from underground attack, he began another series of experiments.

He developed some new varieties which had two rows of flowers on the stem instead of one. Some had four rows. A few had their flowers arranged spirally around the flower stalks. At the same time, he enlarged the size of the bloom and increased the quality and beauty of the petals. Among all these hybrids he had one variety of which he was very fond. In it two flowers seemed to be merged into one in such a way that there were twelve petals instead of six.

It is not easy to explain just how Mr. Burbank could successfully anticipate a certain tendency in flowers. His ability to forecast was, of course, based upon many years of experience and careful observation. It must be remembered that he studied each new plant systematically from the time the first leaves showed above the ground until he reached a decision as to whether it was to be destroyed or retained. After making millions of observations of this sort he naturally developed a habit of predicting what kind of flower would be borne on a certain type of stem.

As an illustration of the practical nature of this forecasting ability, he learned that when two light-colored varieties were crossed it is very unlikely that a blossom of a desirable color would result. Usually the new blossom is neither white nor yellow. A pale pink crossed with a white gladiolus is almost sure to produce a flower that is too pale to be called pink yet too pink to be called white. The blossom is not at all attractive. In the same way he learned what to expect from other combinations.

While new varieties of gladioli were usually produced by planting the seeds of any gladiolus plant, he made headway faster by selecting the parents and working toward a definite end. If he had merely planted any

which came into his possession, he would have depended entirely upon chance for results. But by selecting the parents, making his own crosses, and working toward a definite end he was able to create varieties which were far more prolific and much more beautiful than any that had been developed in Europe.

To look at the blossoms which appeared on his acre of new varieties was to feel that some remarkable artist had designed the form and color of the blossoms for many of them were of unbelievable beauty Indeed, it was an artist who designed them — a celestial artist for although Mr Burbank guided Nature toward the end he des[...] was Nature working in her intricate ways which [...] about the new beauty of form and color

THE GIANTS HAD A SECRET

One of the flowers which fascinated Mr [...] when he came to California was the Amaryllis. [...] Amaryllis growing in the West is pink. [...] few years after he began his work, he received [...] various types of Amaryllis from Chile Peru [...] Mexico and South Africa and these bore flowers [...] different shades.

As he looked at the blossoms of these various [...] he somehow felt that it would be possible to make blossoms as beautiful as those of the smaller sizes, [...] therefore set about to make crosses in every way th[...] could But at first, his experiments were not a su[...] Seeds were not produced There was evidently a sec[...] which he had not unraveled and this he often refer[...] to as the "secret of the giants.

Finally he discovered that the pollen is borne by the Amaryllis flower several days before the pistil is ready to receive it This is apparently a provision of Nature to prevent the pollen from fertilizing the pistil of the same flower After the petals have started to wilt, the pistil ripens and the end bursts open, providing three sticky

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surfaces on which pollen may be received from some other blossom which is just shedding its pollen.

After he learned the "secret of the giants" he selected flowers bearing pollen and kept them in boxes until the three sticky surfaces on other blossoms were ready. Then his crossing resulted in seeds; the seeds were planted, and new varieties came forth.

As was his common experience, the first ones appeared to have no special value. But again this did not discourage him and he made crosses between these new kinds.

lthough the second generation was not much better than the first he continued to cross until, in the tenth gener- n from the original, giant blossoms were produced. [illegible] of them measured ten inches across. Some had [illegible] petals than varieties previously known. The colors [illegible] led from white, striped with red, to a clear fiery scarlet.

The Amaryllis multiplies by offshoots from the bulb 1 other words, additional bulbs grow from the original ne each year. These will then produce a plant which has flowers like the parent. This is the only way that a new Amaryllis can be multiplied; the seeds will not reproduce true.

Most of the species with which Mr. Burbank started to create his "giants" would produce four or five new bulbs in a year; but the new varieties had as many as fifty in a year! Consequently these new kinds multiplied much faster. This was a great advantage to a seedsman who bought a *Burbank Giant* Amaryllis to introduce. Instead of having five bulbs to sell, he might have fifty.

Another characteristic of prolificness appeared in the new kinds. Instead of producing one stalk from a bulb, four or five stalks grew. Some had as many as twelve flowers on one stem!

Also the bulbs of these new kinds were generally larger. A large stalk grows from a large bulb and a large blossom needs a large stalk. The new plants were giants

from head to foot so to speak—or more accurately from bulb to blossom

After Mr Burbank had a large collection of these giants in his garden as well as blossoming plants of the many foreign Amaryllis, visiting horticulturists, seedsmen, and scientists stated that his was the best collection of Amaryllis in the world. It included the greatest diversity of forms, and the most unusual individual plants.

As a matter of fact, his garden has never been duplicated anywhere. It was not a formal garden in any sense of the word he did not plan his grounds to be a show place. But the plants in his experiments were so unusual and so attractive that people who came to visit him were fascinated by what th y saw

When the Amaryllis experiments were under way he had many new varieties to sell each year In August, 1 00 he issued a catalog entitled "A Brief Descriptive List of the New Burbank Giant Amaryllis. In this catalog h described one hundred and thirty-six n w kinds. These were offered at prices ranging from $5 up to $350 per variety The purchase price included all of the bulbs of the new variety in existence He kept none for him self and he had sold none previously So the purchaser had the exclusive right to introduce the new Amaryllis.

One of his new hybrids called *Martinique* was described in this catalog as follows

A remarkable new hybrid of the *Sprekelia formosissima* or Jacobean lily with the Amaryllis (*hippeastrum vittata*). One of the most unique hybrids which has been produced among the bulbous plants. The flowers are fiery crimson like those of the Jacobean lily but very much larger being nine inches in diameter But even more remarkable are the long cu twisted ls which give the flowers a strange ap found anywhere else among the A

"Leaves are pale green, uprig inch wide, eighteen to twenty inch

fiery crimson on slender stems one and one-half to two feet long—usually two flowers to each stem

I have now produced 58 large bulbs and 57 small ones of this new hybrid. Price for the whole stock with out reserve, $350 '

As compared to his high priced variety he described a kind which he was willing to sell for $5 as follows

"Clear red large light-green foliage, no stripes on flower but shadings of crimson and white toward the base of each petal Three bulbs, $5

A variety which he offered at $240 was described as follows

'Early prodigious multiplier Pure deep scarlet with shades of crimson, no stripes. Light green foliage. Two to four flowers on each stalk. Flowers eight inches cross. Petals three inches wide Height about three feet. 120 bulbs, $240

The total price he asked for the 136 varieties described in this catalog was $5,504. Most of them had no names He left the name to the purchaser

These new kinds were remarkable as cut flowers, some of them remaining in perfect condition for ten or twelve days.

The giants had a secret. Mr Burbank learned it, and produced over $5 000 worth of a giant species of Amaryllis.

GIANTS AND DWARFS APPEAR

'You ve been reading *Alice in Wonderland* said a seedsman to his associate when he was told that giants were seen growing side by side with dwarfs in the ex perimental grounds at Sebastopol

A family prod ces either large plants or small plants —never both ' he explained.

This illustrates how difficult it was for those not visit Mr Burbank s grounds to believe

occurring there. While he was experimenting to get a fragrant calla, he developed varieties with giant blossoms ten inches across and he developed others with blossoms only two inches wide. Both of them were attractive one because of its huge size the other because of its daintiness.

The giant flowers were borne on stems six feet or more in height The leaves were also huge in size. The dwarf grew beside the giant and had short stems, small leaves, and dainty white blossoms. There were all sorts of colors in this field of strange new varieties. Many were yellow One an offspring of the giant calla, produced a blossom which was almost crimson even the flower stalk was red One was green where most callas are white.

The astonishing variations which were so easily produced in Mr Burbank s garden demonstrated that the calla is an interesting plant with which to experiment. The calla of course reproduces from bulbs. All that is necessary to get new kinds is to plant the seed every calla seed will produce a new variety whether a special cross has been made or not.

As a result of his experiments, Mr Burbank introduced five callas with the following names *Dwarf Everblooming Fragrance Giant One Best*, and *Snowflake*

He also worked with cannas, having at one time as many as half a million new seedlings growing on his Sebastopol place From these seedlings he introduced two new species, one named *Burbank* and the other *Tarrytown*. The *Tarrytown* was a beautiful brilliant crimson flower which received the Grand Gold Medal at the Pan American Exposition at Buffalo as the best canna exhibited—and there were large numbers in competition. As was the case with most of his new flowers, the *Tarrytown* was unusually prolific The original had nine stems growing out from the main stalk.

The petals of most cannas remain on the flower stalk after they have faded. Mr Burbank thought this an undesirable characteristic and selected for a neater flower

following the blooming period The petals of the *Tarrytown* drop to the ground as soon as the blossoms fade thus, the flower stalks always look neat.

This famous *Tarrytown* canna was produced by crossing a native canna secured from the Florida Everglades, where it is known scientifically as *Canna flaccida* with the cultivated variety known as *Crozy* canna. The Florida plant produced large, lemon-yellow flowers. The flowers of the *Crozy* varied in color Probably these two species had never been joined before and their development had been along lines so different that, when the pollen was taken from one to the other the resulting hybrids proved to be most useful in Mr Burbank s work.

This crossing, however was not so easy The cannas are pollinized quite largely by hummingbirds. And when two species as distinct as those Mr Burbank used are brought together difficulties often arise when artificial pollinizing is attempted As a matter of fact, Mr Burbank worked for eight years before he succeeded in making the crosses.

Before Luther Burbank's time, it had been the plan of those who grew the canna from seed to file off a part of the hard thick shell of the seed so that moisture might be absorbed If this was not done, the seed would not germinate for a long time. This technique did not appeal to Mr Burbank because he wanted to work with a large number of seeds, so he devised a method for mass production.

It was this He soaked the seeds in a solution of copper sulphate. He then placed them in rather coarse gravel which had been sterilized by being boiled. He poured water through the gravel t frequent intervals This helped to prevent fungus growth fungus damage would have been most likely if the seeds had been planted in ordinary soil.

Even with this preparation, it required several m for the seeds to germinate. He discovered

these seeds would germinate at a lower temperature, he got better results if the temperature was kept between 60 and 70 The temperature could be controlled in his greenhouse where most of his seeds were started in flats

The seedlings were transplanted shortly after they showed themselves above the ground and in the month of May he again transplanted them into the garden. There cultivation was the same as for other seeds.

A large number of the seedlings were absolutely worthless but persistence bore results The *Burbank* and the *Tarrytown* cannas justified the patience and hard work he had given them.

14. NUTS GROWN WHILE YOU WAIT

In Massachusetts, as a boy young Luther Burbank made annual trips for the gathering of nuts. One of his favorites was the chestnut. He was interested in learning about the growth of the tree and the possibilities of improving it.

In California, he was able to carry on work of this kind on a larger scale. Twenty five chestnuts were in his first shipment of seeds and plants from J pan in 1884 These were planted, and trees which grew from them proved most valuable in his experiments

Hybrids were made by crossing these first seedlings with other varieties from Europe, China and America. Eventually there were some hybr ds with habits so strange that they seemed to be new races of plants.

The most astonishing characteristic was the ability to produce full-sized hestnuts in six months from the planting of the seed ! These were truly infant prodigies no nut tree had ever done such a thing before so far as anyone knew Most of the nut trees do not produce flowers or nuts until they are ten years old or more. Even then, the crop is often small until the tree is twenty years old

But now Nature has yielded to man s impatience and given the food desired from the chestnut tree in such a short time that the crop might almost be compared to a crop of grain or vegetables.

To be sure, not all of the seedlings bore nuts so early in their lives, but many of them bore nuts within eighteen months from the planting of th seed. Each tree which grew from a seed was f a new variety although there were important similarities. Best of all most of the nuts produced on these hybrids were good to use as food.

The trees were often not more than twelve or eighteen inches tall when they began to bear and it was hard to believe that they were really trees. The branches were covered rather thickly with large green spiny shells and some of them had from six to nine nuts in each shell, whereas most chestnuts have only two or three

Mr Burbank was delighted with the quick response of the chestnut for this gave him an opportunity to make many more generations of hybrids within a few years than would have been possible if the trees had not come into bearing until they were older

Some of these hybrids were so eager to reproduce themselves that they bore continuously some nuts ripening almost every month of the year Others bore nuts two inches in diameter and weighing about an ounce. However these large nuts were usually not so good in flavor as those of a medium size

As a result of this work, Mr Burbank introduced three varieties of chestnuts one known as the *Hale* one as the oe and one as the *McFarland* These were named for the men to whom they were sold and these men took the responsibility of introducing them to orchardists. This was the beginning of chestnut orcharding

In Massachusetts young Luther Burbank had also gathered hickory nuts, from the hardy shagbark hickory which grows in the North. In California, he came to believe that important results might be obtained by crossing the hickory nut and the pecan which are closely related. The pecan, of course is not hardy and lives in th South, mostly in the Gulf states. Frost can kill pecan trees nd cool nights will prevent the nuts from ripening

The pecan was the only native nut tree which had been d v loped as an orchard tree at that time. Its thin shell and its delightful flavor made it popular The pecan orchard tree is made by budding or grafting, and there are many profitable pecan orchards in the southern states.

By crossing with the hickory Mr Burbank hoped to

nut combining hardiness with delectable taste This he was not able to do however because the shagbark hickory ld not thrive at Santa Rosa or Sebastopol. At one time, e received specimens of nuts which he believed were ybrids of the shagbark and the pecan. But the seedlings which grew from these were destroyed by the pocket ophers and he was never able to complete the tests with hem.

The difficulty in working with the hickory nut is that t does not bear fruit until it is ten or twelve years old In other words, it requires ten or twelve years to produce one generation. This makes the work of the plant improver very slow if he is going to create many generations of hybrids.

Mr Burbank discovered that one of the reasons why the hickory tree (and pecan) grows so slowly is that it develops a very extensive root system. In the course of his work, he determined that about ninety-nine per cent of the growth during the first year is underground. Some pecan seedlings which he grew had roots from four to six feet long and an inch in diameter in the first year's growth, whereas, above the ground, the young tree was only about an inch high.

There are doubtless two steps necessary in the improvement of the hickory nut. The first step would be to produce hybrids which would come into fruiting early in their lives, like the Burbank chestnut; the second step would be to make improvements in other qualities. Without early fruiting, th experiment would extend over so many years that no one man would be likely to complete the job.

While Mr Burbank made some effort to improve the hickory nut, he left the main part of the job to someone lse and the success which growers have had with the pecan points t the value of developing varieties ... grown farther north.

Mr Burbank thought that th
crossed with the walnut and the

are closely related. He never tried this experiment, however

With walnuts, Luther Burbank's experiments were as amazingly rewarded as his work with chestnuts No wonder he called one variety the *Royal* walnut; it produced nuts so valuable and in such great quantities that one year's crop from one tree was sold for a thousand dollars.

When the *Royal* walnut was developed, many men in California were planting orchards of English walnuts. It was discovered that the seeds of the *Royal* walnut produced root stocks n which the English walnut thrived, the English walnut trees re much less subject to disease when grafted on the *Royal* root stock. Furthermore the English walnut produced larger crops when it had the *Royal* walnut as the food gathering part of the tree

As a boy Luther Burbank had gathered black walnuts in the woods on his father's farm When he went to California, he discovered that the English walnut and the ack walnut are related to each other He also found a ack walnut growing in California which was called the *California black walnut* When he crossed it with the Eastern black walnut he got the valuable new variety which he called *Royal.*

He also crossed the California black walnut and the English walnut and obtained other interesting hybrids. Some of these grew at a tremendous rate. Furthermore they kept up this rapid growth year after year One of them grew to be sixty feet tall its branches shading sixty feet of ground with a trunk two feet in diameter when the tree was only sixteen years old. This is unheard-of growth for a walnut.

Visitors remarked about the beauty of the tree and Mr Burbank told them that it was only half as old as the English walnut trees which were growing on the opposite side of the street and which were only eight inches in diameter at thirty two years of age

This remarkable new walnut was introduced as the *Paradox* When the seeds of the *Paradox* are planted, some will develop into very rapidly growing trees, similar to the *Paradox*, while others grow like dwarf The dwarf may be only six inches high when the giant beside it is twenty feet high!

The branches of the *Paradox* had a tendency to droop which added to the beauty of the tree. The leaves were long and, instead of having the strong odor of the black walnut, they had a fragrance resembling an apple

Although the *Paradox* did not produce a large crop of nuts, it was valuable for the beautiful dark lumber whi h could be sawed from its trunk It was comparable to the black walnut tree of the East in this respect and inasmuch as it grew more rapidly than ther lumber trees, and at the same time produced the very best of cabinet wood the *Paradox* was destined to be of very definite value as a lumber producer

It was first thought that, because of its rapid growth, the *Paradox* would produce a soft rather than a hard wood However compared with the wood of the eastern black walnut, it was found to be almost as hard

Mr Burbank was a pioneer in the improvement of forest trees. Most people had considered the forest trees as more or less stable little thought had been given to improving them. But this attitude changed when the *Parado* demonstrated that a tree can grow into a marketable crop in sixteen years.

Today the importance of growing new forests as we grow any other farm crop is widely recognized It is true that most of the forest trees, such as th white pine, require forty to sixty years to produce a crop of lumber but there is no reason why this time cannot be greatly shortened by developing faster growing varieties. The Burbank experiments, by producing the chestnut prodigies and the *Paradox* walnut, have proved that it can be done.

15. FAMILIAR FRUITS TRY NEW TRICKS

Although no one believed that the tender peach could be made to grow where temperatures descended to fourteen below in his characteristic manner Mr Burbank set about to increase the hardiness of this particular fruit, so that it might be possible

The idea of breeding trees which would be immune to disease and insects was considered to be the fiction of a dreamer

This skepticism made no difference to the plant magician of Santa Rosa. He started to cross peaches and nectarines in 1895 with the hope that he might produce some new kinds which would be immune to common pests and which would withstand cold winters. He wished to widen the territory in which these delicious fruits might be grown

The variety called *Muir* was known to be resistant to curly leaf a disease which was destructive in many peach orchards. So he decided to cross this with the nectarine which is a smooth-skinned peach with white flesh. It was the sixth generation before he had a new variety of peach which he thought was worthy of introduction. It was named *Opulent*.

The tree was vigorous and prolific. It started to bear fruit when it was still quite young The fruit had a white skin with numerous dots and shades of both light and dark crimson. The flesh was a pale lemon yellow and the flavor was delicious. Many declared when they tasted it, that it was the most delicious of all peaches.

The new tree was resistant to the curly leaf disease and tests made as far north as Canada showed that it would endure a temperature as low as forty degrees below zero In seasons following this low temperature, the

Opulent trees bore full crops of peaches although other peach trees were killed by the severe cold.

While the *Opulent* had many unusual characters which were of value to the orchardist it lacked shipping ability It could be used and sold locally but it would not arrive in perfect condition when shipped entirely across the country

Mr Burbank later introduced two other varieties one called the *Leader* the other called *National* But he did not stop there. He kept on with his experiments and four additional varieties may now be purch sed from nurserymen with the names *July Elberta Burbank's Giant, July Gold*, and *Burbank's Giant Freestone*.

The *July Elberta* is referred to as 'Burbank's Master piece." It ripens twenty days before Elberta. It bears when only two years old. It is hardy doing well in Canada. The flesh is firm juicy and delicious Shippers like it because it arrives at distant markets in perfect condition. It is ideal for commercial orchards.

Burbank's Giant is a huge yellow freestone peach often measuring three and a half inches, and sometimes four inches in diameter The seed is very small The tree begins to bear in its second year and has thrived after a winter of fourteen degrees below zero But it is best suited for the home orchard, for it does not ship as well as others

The *July Gold* is a big clear orange-yellow freestone peach which ripens earlier than the *July Elberta*. It is a hardy young bearer and is said to be the best early yellow freestone Red and gold in colo and a splendid shipper, it is attractive on the market after being shipped a long distance. It ripens twenty days earlier than its parent, the *Elberta* and one grower reports that, because of th earliness and splendid quality he gets from $3 to $4·20 a bushel. His orchard is in a section where temperature sometimes goes to twenty four degrees zero

Burbank's Giant Freestone is described as of huge size, of great beauty and of delicious quality. Its flesh is a clear golden yellow and the tree bears when very young and it is extra hardy.

Mr Burbank also introduced two nectarines as the result of this work. One is called *Flaming Gold*. The other is sold as *Burbank's Blood Nectarine*.

The *Flaming Gold* is a wine red blushed over vivid gold. It has a "rich golden orange flesh of honey sweetness and champagne sprightliness." It is a freestone and the stone is small. The flesh is firm which makes it a good shipper. It ripens a week before Elberta peaches and withstands temperatures as low as fourteen degrees below zero while its growers report it to be very resistant to disease and rot.

Burbank's Blood Nectarine is so called because of its blood-red flesh. It is the only one ever developed with this color. Reported by growers to be free from rot and cracking it is recommended for local use only and is especially good for canning.

The almond is a close relative of the peach and Mr Burbank made some interesting crosses between the purple-leaved peach and the Languedoc almond. The two fruits crossed rather readily but most of the seedlings had leaves like the peach. Those which resembled the almond grew more rapidly than those which resembled the peach.

In further experiments he used what is known as the "double flowering peach" from China and Japan. The blossoms are about an inch and a quarter in diameter, some are white, some pink, and some a deep crimson. They are double flowers and look like roses. They are produced in such profusion that the trees are splendid ornamental plants. However they are subject to mildew and curly leaf in this country.

The fruit of these trees is of no value. The stone is very large and the flesh does not have a good taste. By

crossing these with some of the standard varieties of peaches, Mr Burbank was able to get some flowering trees which bore better fruits however these fruits are more useful for cooking than for eating raw

He continued to work with crosses between the almond and the peach in the hope that he might get a fruit which would be desirable and a seed which would be as good food as the seed of the almond While he made progress toward this end he did not reach his objective at least not to his own satisfaction There were some who thought that he had what he wanted, but his standards were higher than theirs and he did not introduce the variety

He also crossed the peach and the plum, using a Japanese plum and also a plum called the Chickasaw—an American variety Perhaps if he could have continued these experiments long enough he would have produced a stoneless peach, as he had produced a stoneless plum.

These experiments show that it is entirely possible to work toward a definite objective and reach it. He was able to produce varieties of peaches which will withstand cold winters and which will be immun to common peach pests. He had placed great emphasis upon freedom from mildew and curly leaf and his two peach varieties, *Leader* and *National* proved to be unusually free from these pests.

It is clear that his early determination to make hardiness one of his chief principles was justified, fo he greatly extended the areas in which desirable fruits can be grown. This accomplishment alone was of sufficient importance to establish Luther Burbank as a world leader in horticulture

A PEAR TREE RESISTS PESTS

If fruit growers never had to fight tree pests, their returns would be much greater This idea was always very much in Mr Burbank' mind, and he continually sought for trees which the pests would not attack. When he began his work with the pear he determined to (

a tree which would be immune to injury by insects or diseases.

He made importations of a number of plants and seeds from Japan in 1884 and in this shipment there were twenty pounds of pear seeds. Then, in 1890 he imported a large quantity of the seeds of the sand pear from China.

Seedlings of both these oriental kinds were most interesting Some were fast growers some grew very slowly Some had very good fruits the fruits of others were of no value Some died after a few years of growth others seemed to be thrifty

He used the pears that were commonly grown in America as a source of pollen for crossing these oriental species, and obtained many hybrids, some of which produced fruit of large size and good quality But most important one of them proved to be immune to blight and other pests which infest most pear trees

He worked with seedlings and hybrids of the pear however for nearly twenty five years before he finally introduced one in 1911 with the name *Test* This new pear had produced two or three times as much fruit as any other variety and the fruit was larger than the *Bartlett* pear It was a variety liked by the orchardist for its immunity to disease and insects and the good quality of the fruit.

Inasmuch as the pear the apple, and the quince are closely related, Mr Burbank tried crossing them. The three fruits belong to the rose family but each is classified in a separate genus. He made a pear-apple hybrid an apple-quince hybrid and a pear-quince hybrid.

The seedlings grew well but none of them ever blossomed. Nevertheless, Mr Burbank did not believe that it was impossible to cross the fruits successfully He concluded that he had not used the right varieties for making the cross, or else had the wrong individuals. From his experience he knew that some individual plants will resist

he was never willing to say it was impossible to cross any two plants

Since a pear tree that produces no fruit is of very little value, he promptly consigned these hybrids to his bonfire. The crosses simply represented one of the many interesting experiments he tried without success.

When the seedlings resulting from the hybridization of the appl and the pear would not bloom while growing on their own roots, he tried grafting them onto an ld apple tree. There they grew for a while but did not bear any blossoms or fruit. Approximately the same results were had with the hybrids of the pear and the quince.

When it is realized that Luther Burbank introduced two hundred and fifty or more new varieties of about fifty different classes of plants, it might be thought that everything he attempted was a success. But that is not true He tried many more experiments which failed than those which succeeded. It was his persistence in spite of failure which made him the world s leading horticulturist.

It must be admitted that while Mr Burbank worked a great deal with pears, he did not produce enough new varieties to justify the great amount of work. The same conclusion might be reached with respect to his experiments with apples. He introduced only two varieties, the *Gold Ridge* and the *Winterstein*. However he grew thousands of seedlings and thousands of hybrids.

He estimated that he grew more than fifty thousand seedling apples from the time he began in 1886. In addition to the two he introduced he had about ten others which were better in certain respects than existing kinds.

While he used about an acre of plums as host trees for his plum experiments, h used only one apple tree. The apple tree grows very much larger than the plum and he was able to grow as many as five hundred and twenty-six varieties on this one tree t a time. Instead of walking through row after row as he had to d when selectin new plums, all that was necessary with the apple v

climb a stepladder and examine the fruit on the various cions covering the tree.

Those who visited his Sebastopol place were astonished at the appearance of this one apple tree which served as nursemaid to these five hundred and twenty-six varieties, yet to Luther Burbank it was simply a practical expedient to speed up his work without using too much land.

With the apple as with the pear he watched for varieties which would be immune to insects and disease. He made attempts to find varieties of pears which could be used as root stocks to give immunity to apple tree when grafted on these root stocks. The experiments, how ever did not meet with success.

The *Northern Spy* apple is immune to the woolly aphis, and he tried to make use of root stocks grown from *Northern Spy* seeds in order to transmit thi immunity But for some reason the immunity wa not transferred and this experiment failed.

He was finally able to cut twigs from the *Northern Spy* and root them in the ground, where they grew to sufficient size to be used as root stocks for other apple varieties.

During his experiments with apples, he imported various kinds from Australia and New Zealand Some of these would not send out any blossoms at all Others continued to send out blossoms the year around.

He made additional crosses between the wild crab and a variety of apple called the Gravenstein hoping to add the hardiness of the wild variety The seedlings were interesting but produced no new variety worthy of intr duction

A QUINCE TREE WORKS OVERTIME

It is not easy to believe that a fruit tree can be three crops per year even in California. But under favor able conditions the first quince which Mr Burbar

introduced, the Van Deman, produces three distinct crops each season

The first crop is ready in September and is made up of huge fruits about five inches in diameter and weighing about twenty five ounces each. The second crop is harvested in November and is made up of fruits of smaller size, but of just as good flavor and texture as the first crop. The third crop is smaller and is gathered in December These quinces are especially good for baking They also may be dried and canned.

The *Van Deman* quince was awarded the Wilde Medal at the meeting of the American Pomological Society in Washington D C in September 1891 It was so admired by Professor H E Van Deman, who was then chief of the Division of Pomology in the United States Department of Agriculture that Mr Burbank *named it for him*.

The exact parentage of the Van Deman quince is not easy to list, because Mr Burbank made crosses and recrosses of hybrids many times before he finally obtained a variety which he deemed worthy of introduction. He had used varieties in these experiments which were known as *Orange*, *Angus Portugal*, *Rae's Mammoth*, *West's Mammoth*, and *Champion*. He estimated that he had tested bout fifty thousand quince seedlings before he had one which was worthy

The *Van Deman* is known for its productivity its size, its globular shape, smooth skin, and attractive color It has a spicy flavor and a tender flesh and is remarkably hardy

The second good quince which he introduced was a seedling from *Rae's Mammoth*. This variety had been crossed with the *Portugal*, *and the new variety ppeared* in the third generation. It was first called the *Santa Rosa* but was renamed *Childs'* quince after it was sold to a nurseryman named Childs.

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The tree bears large fruits and is very productive. The beautifully formed fruit is almost white or a pale yellow its flesh is tender and of a delicious flavor and the core is very small Many people consider it equal to a good apple for eating raw This is an unusual quality for a quince, for quinces, before this time had been known as cooking fruits only

About fifteen years after Luther Burbank began his work with the quince he produced a new variety which excelled all others in its delicious flavor In fact, it had the flavor of the pineapple, and so was named the *Pineapple quince* Its large and uniform fruit, of a pleasing light yellow color is good when eaten raw It cooks quickly usually being perfectly tender in about four and a half minutes, and makes a delicious jelly with a strong pure pineapple flavor

The *Pineapple quince* proved to be the first variety which could be shipped successfully from California to New York A California orchardist shipped a quantity in twenty pound plum crates in 1910 The first shipment sold for $3 *0 per crate—seventeen and one-half cents per pound!

Mr Burbank carried on many other experiments with quinces. As a matter of fact, he began as early as 1884 to cross the oriental quinces with the American varieties These crosses never produced a tree which bore blossoms, although he grew thousands of seedlings. However, some of these oriental varieties proved to be beautiful flowering shrubs and were introduced for decorative purposes. Thus the lowly quince the Cinderella of fruits with no social standing was transformed by the plant magician and took its place among the socially prominent apples and pears

THE "PLUMCOT" ANSWERS ARGUMENTS

In general Luther Burbank was not concerned with rules or classifications which man made because all he

nted was new plants which would better serve man- od. He didn t care whether these were secured by fol- wing established rules or procedure already formu- ed, or whether they were secured in some new way they could be had he wanted them

He felt that, if he allowed himself to be held back by ne of the rules, he would not be able to give very any new plants to the world. Certainly we would not ve had the *plumcot* a new species of stone fruit com- ning the hardiness of the plum and the delicious flavor d aroma of the apricot for one of the rules quite nerally believed was that "New species cannot be eated.'

Scientists living before the time of Burbank who assified living things into groups had placed the stone uits into a genus called Prunus. A separate species ame was given to the plum another to the apricot, nother to the cherry and so on.

Experience up to that time seemed to indicate that pecies are so distinct from each other that they cannot e combined. N one had been able to cross the pollen rom one to the other It was thought that it would not e at all possible for the pollen of the apricot to grow f it were placed on the pistil of the plum and it would not be possible for the pollen of the plum to grow if it were placed on the pistil of the apricot.

Mr Burbank knew this rule, but he had known rules to be unreliable in other cases was this particular rule correct ?

The apricot had always appealed to Mr Burbank as a most deliciously flavored fruit, but there were many climates where it could not thrive. On the other hand, his work with plums had taught him that plum trees are the most hardy of all the Prunus genus. He had already worked with *Prunus triflora* a Japanese plum with *Prunus simonii* a Chinese plum with *Prunus* a European plum and with several other spec

His first attempt to combine the delicious flavor of the apricot with the hardiness of the plum was a failure The pollen would not grow on the other species, and it looked as if those who sa it was impossible to cross plants of two distinct species might have been right.

However Mr Burbank kept on trying. In making the unusual crosses, his method was as simple as ever he picked a blossom from an apricot tree and scattered the pollen on plum blossoms. He also picked plum blossoms and scattered the pollen from them on the apricot s blossoms. If those who believed he was violating a law of Nature had been there they might have tried to discourage him. If he had paid attention to the prohibitive rules of man, he would have told himself long before that Nature would not make such a cross.

But he knew from his own experience how often persistence had brought rewards often in his efforts to guide Nature in the direction of plant designs more useful to man he had made thousands and thousands of crosses be- re he btained a single mature seed. Finally a few seeds re produced from a cross between one of his Japanese lums and the apricot

As soon as he saw the new trees thrusting their leaves above the ground he recognized a combination of the characters of plums and apricots in the bark, the leaves and the terminal bud. And when he examined the roots he saw even more astonishing manifestations. The apricot root is an entirely different color from that of the plum. The plum is usually a pale color yellow or sometimes white but the roots of the apricot are red. The first of his hybrid seedlings had dark red roots.

As he expected a large proportion of the new seedlings showed undesirable characteristics. But following the practice he used with plums in order to get fruit more quickly he grafted cions from the promising seedlings on old plum trees In two or three years he began to see fruit of this new species of Prunus.

The fruits were neither apricots nor plums. To be sure, ey were somewhat the color of plums, although the lor varied between the different seedlings. The flesh was rm like the plum rather than soft like the apricot. But any of the stones were almost exactly like the apricot ones, while a few much resembled the peach Most of the its had a sharp projection along one edge which is a haracteristic of the apricot. When the fruits ripened and e made the taste test, he realized that h had fruits unluely dalicious.

After a period of years, he found that he had trees far more rugged than those of the apricot. He had indeed, made a combination of the apricot and the plum, and it was appropriate to call the new fruit *plumcot*

It was not often that Mr Burbank exhibited his new fruits at fairs but in 1901 he showed some of the new plumcots at the Pan-American Exposition held in Buffalo New York. Not only did the exhibit attract big crowds of visitors, but a special gold medal was struck by the officers of the Exposition and given to Mr Burbank. Of course, these new fruits had no classification at the Exposition and so no prizes were offered.

When a fruit so new as the plumcot is created it might be thought that the seeds would produce either a plum or an apricot when planted, but the seeds produced plumcots—never plums and never apricots. This indicated the creation of a new species which perpetuated itself through its seeds.

One of the first of the new plumcots was sold to Don M. Rutland of Australia. This variety was named the *Rutland plumcot* and Mr Rutland introduced it into the southern hemisphere, including Africa. This same fruit was introduced to the northern hemisphere by George C. Roeding of Fresno California.

Nurserymen still sell at least six Burbank plumcots with the following names *Apex, Corona Triumph, Purple,* and *Orange.*

When Mr Burbank crossed the apricot and the plum, he showed that the old rule was an error either the fruits had not been properly classified or he had proved that distinct species can be crossed. *So it is not surprising that* Mr Burbank felt it unwise to try to set up general rules about Nature he proved many times that Nature's possibilities are limitless.

He often said with reference to the rules "If men who are trying to determine the rules of Nature would look for positive rules, rather than negative ones, they might be more successful, and they might discover that their rules would be less often violated."

Naturally Mr Burbank loved the rose, as everyone a. So he began work with it early in his career ecting and crossbreeding in a way similar to his techue with other flowers. His first introduction was a dding rose which was called the *Burbank*. It was awarda gold medal as the best bedding rose at the St Louis ernational Exposition in 1904.

One of the interesting things about the *Burbank rose* s that it was produced in somewhat the same way as e *Burbank potato*. That is a seed pod was found on a ermosa rose, which rarely bears seeds. However the w rose did not come directly from the original seed did the *Burbank potato* which was ready for introduoon as soon as it had produced tubers. It was necessary o cross the pollen from the seedling rose in order to get he one which was finally introduced.

As a matter of fact, it was crossing which produced the igor and other unusual qualities of the *Burbank rose*. It as hardiness sufficient to enable it to be grown in southrn Canada and it was soon recognized as the hardiest of ll ever-blooming roses. It continues to bloom throughout the entire season, with the result that probably no other rose produces as many individual flowers in a year as does the *Burbank*.

Perhaps the strangest characteristic of this new plant was that it began to bloom when the seedling was only two or three inches high! Such early flowering had never been heard of before.

Another important characteristic, which should be emphasized in order to make it clear that Mr Burbank was always looking for plants which would be resistant to pests is that the *Burbank* rose is immune to the attacks of mildew and rust

Of course, he used exactly the same methods in producing a rose that would be resistant to these pests as he did in producing other plants which would avoid trouble for the grower He watched the seedlings, and if any seedling showed susceptibility to damage by any disease or insect, that seedling was immediately destroyed

Fortunately for Luther Burbank's experiments, susceptibility to disease and insects is likely to become apparent almost the first year the seedling grows. If the new plant grows through three or four years of tests without being damaged by insects or disease, it is quite likely that its immunity has been established.

While the *Burbank* was a most beautiful rose, these other qualities need emphasis because it has been a temptation to some who have grown seedling roses of beautiful color quality to introduce them regardless of their susceptibility to disease and insects In other words it is a genuine temptation to judge a new flower entirely by the blossom and to neglect the plant itself.

Perhaps it was because Mr Burbank had been a ractical gardener and nurseryman that he realized the portance of studying the plant as well as the product to be used by man In order to maintain this policy of selecting only the hardiest, Mr Burbank destroyed thousands of seedling roses whose blossoms gave great promise but whose stems did not come up to the Burbank standard

He could easily have introduced many thousands of new plants which the public never saw Seedsmen would have bought many of them if he had given them the chance But as a boy he set his standards high, and he was never tempted to vary them. The man who talked to him on the train as he was going to California stimulated him to put into words a policy which emphasized hardiness of plants as a characteristic which he would never neglect.

He also selected for keeping quality and as a result he had some seedlings whose blossoms lasted twenty five or thirty days when left on the bush and fifteen or twenty days after being cut.

After learning of the great quantities of individual illings which Mr Burbank grew in order to get one t was worthy of introduction some people have referred his methods as pure luck. He grew over 200 000 illings from the crimson rambler rose which had been sed with other roses. This was not just to strike a y hybrid but it was necessary to work with such nbers to help Nature eliminate the many which are of value whatever

The production of just the right hybrid cannot be per tly controlled by man, but the selection can be con lled. And the variations can be brought about by ss-fertilization Furthermore selections for future hridizing are made by man as steps toward the goal hich he has set.

In several of Mr Burbank experiments these steps re not only tedious and expensive, but discouraging e might hybridize and select for twelve years in work g toward a certain type of plant without getting very ar to it.

It is clear that the making of a desirable new plant is ot as exact a process as the turning of a plow round on lathe. It might be said to be even more complicated han the making of an automobile. Automobile parts can e designed perfectly on a drawing board and can be exe- uted on specially built machines with th knowledge that arious parts will fit together But in the making of a ew plant, the drawing board design, which, by the way s usually a mental design, cannot be converted into parts which fit together exactly So it was necessary t grow housands, yes hundreds of thousands of rose seedlings n order to get eight which were introduced up to the year 1912.

This need not discourage amateur plant improvers, however There are times when the first crossing does yield a better plant. It is true that it doesn't happen very often but it does happen sometimes For the *Burbank* potato was selected from only twe

seedlings. The *Burbank* plum was selected from twelve seedlings.

The real compensation for the amateur plant improver is to be found in the unexpected variations which always appear following every cross-pollination. Each seedling is sure to be different. Some of them will be strange and weird. But most crosses produce at least one specimen which stimulates the plant improver to keep on with the work by pointing in the direction desired.

There were times when Mr. Burbank did not find even one seedling rose which seemed to be developing in the direction he wanted. But because he worked with so many different kinds of plants, this did not end his work. He was getting results with some other plants even though the rose hybrids were failures. He kept on and on knowing that good results might show up in any generation.

Previous to Mr. Burbank's experiments, most growers had said that Nature would not produce a blue rose. But Mr. Burbank did produce a blue rose—or rather nature produced it with his help.

Up to 1912 he introduced eight roses with the following names: *Burbank, All Blossoms, Coquito, Corona, Little Hermosa, Peachblow, Pet* and *Santa Rosa*. One nursery catalog lists three other Burbank roses with the following names: *Copper Climber, Snowhite Climber* and *Golden Sunset*.

But strangest of all his roses was the *Burbank* whose blossoms began to open when the bush was no more than three inches high.

THE DAHLIA WAS A GOOD PUPIL

Mr. Burbank often spoke of the plants in his garden as pupils in a school. He would say that he was trying to teach this pupil to do one thing and that one to do something else. Some of them learned readily; some of them did not.

He regarded the dahlia as a very reponsive pupil. It ıs very easy to produce new dahlias and it was quite ıy to produce just the kind he wanted

Our dahlias originally came from Mexico and Central merica. The Spaniards found them there many years ago hen they conquered Mexico and the bright red and yellow lors appealed to the conquistadors so much that they nt some of the tubers to Spain where they became opular As a matter of fact, experimenters with plants roduced many new varieties before Mr Burbank started is work.

Each seed that is produced on a dahlia will grow into a ew variety The only true reproduction of a certain type s brought about by separating the tubers and growing a lant from each one. It is not entirely necessary there-ore to make crosses in order to get variation But Mr Burbank did make crosses, in order to work toward a defi-nite goal.

One of the astonishing results he obtained was a dahlia with a pleasing fragrance. If a flower can be attractive in the and form and color as the dahlia is, there should be no reason why it could not also be attractive in odor So he made an effort to find one or more which had a pleasing scent

After working for a long time, he finally created a dahlia d with fragrance which reminded him of the magnolia, ... lis though the fragrance was quite faint. His next step was ne to cross this plant with others in the hope that more ... an be found with a pleasing scent.

As new hybrids were made, he selected for scent ... and well as for other desirable characteristics. He saved ... seeds seeds of those which pleased him, crossed seedlings ... d the duced from those seeds with others, and kept ... finally he had the sweet-smelling dahlia which he ... Fragrant.

As a matter f fact, he kinds. He sold three of these

and continued his crossing and selection with other characteristics in mind Many of his new varieties had wider petals some had overlapping petals and there were petals of many different colors. One hybrid had a few petals of a solid color with the rest striped. The dahlia was a brilliant pupil in the Santa Rosa plant school and it is a good plant for anyone who wishes to create new varieties.

Mr Burbank's experiments were largely with the single dahlia. Today many plant breeders have been able to get very large and beautiful double dahlias. A gardener not far from Sebastopol, California, has developed some new hybrids which measure eleven and twelve inches across. Bright yellow and bright red in color they are gorgeous creations.

Huge dahlias may also be seen in other places along the Pacific Coast as well as north of Boston on the Atlantic Coast. These giant varieties are being sold to many people in the United States, and large beautifully formed dahlia blossoms will soon be quite common

The names of ten of Mr Burbank's dahlias introduced previous to 191 are as follows

Burbank	*David Burpee*	*Fragrant*
Giant Yellow	*Golden West*	*Marigold*
Lemon Yellow	*Mountain*	*Sebastopol*
	Unique Salmon	

During all this time, Luther Burbank did not forget his boyhood ambition to produce a new daisy which would be larger and whiter than any yet seen "the most beautiful daisy in the world. When he went to California he took some of the seeds of the wild daisy of Massachusetts along with him. He worked with them for many years before he finally had what he wanted—the flower he had dreamed of and described to his mother

This flower was the result of work with four different kinds of daisies—all of them smaller all less white than the final product which so many people today grow in their gardens.

To see with what Luther Burbank began to create the now world-famous daisy it is necessary only to go into almost any cow pasture and gaze upon the tiny weeds which many farmers call dog fennel" or oxeye daisy They are weeds, without a doubt. Their flowers are very small. Their petals are short. The plants are leafy However the eye of Luther Burbank saw beauty in them, and a future

To start his experiment he was able to get seeds of a daisy from England which had a larger blossom, and grew on a larger plant. He placed the pollen from this European daisy on the pistils of the oxeye daisy and he placed the pollen of the oxeye daisy on the European blossom

He then secured seeds of a daisy from Germany and used pollen from the flowers which grew from these seeds to cross on the seedlings of the cross of the oxeye and the English daisy

The plant which results from the crossing of two distinct plants is called a hybrid. The pollen from ,
themselves almost always had to be placed on

blossoms of other hybrids before very good results were obtained. This applied to all of his experiments.

While the European daisies had larger blossoms than the American oxeye daisy they were not so graceful in form and did not have so many blooms on each plant. They were coarse and woody in appearance. They had many large leaves on the flower stalk which Mr Burbank thought a detriment because the leaves were more prominent than the flowers.

The genus to which these various daisies belong is "chrysanthemum Scientists group plants which are similar to each other into a genus then they subdivide the genus into species the species is further divided into varieties. Usually when the name of a plant is given in scientific language the genus the species, and the variety names are written in order The daisies with which Mr Burbank was now working had no variety of names. The oxeye daisy of N w England has the scientific name *Chrysanthemum leucanthemum* The daisy which he got from England has the scientific name *Chrysanthemum maximum* And the one he got from Germany has the name *Chrysanthemum lacustre*

F'rst, a cross was made between *Chrysanthemum maximum* and *Chrysanthemum leucanthemum.* The seeds which were thus produced grew into plants which bore flowers showing a marked improvement over either kind They were larger in size But all of them had a yellowish tinge So further improvement was attempted by crossing this hybrid with the German daisy *Chrysanthemum lacustre*

It required five or six years to make these various crosses and bring the flowers into bloom but as a result Luther Burbank had a new species of daisies whose blossoms were larger and more beautiful and were produced in greater abundance than any others.

But the flowers still did not have that crystal white color which he so much desired. So he kept right on with

is experiments, collecting seeds each year only from e very best plants and from those which he hoped ould produce a white flower eventually

Finally he discovered a fourth daisy in Japan known *Chrysanthemum nipponicum*. The important thing bout this flower was that, while it was very very small e petals were extremely white.

The flowers which came from the seeds produced by e first crossing with the Japanese daisy were disappoint-ig. But the next season, Mr Burbank saw among the ousands of blossoms produced by this combination of aisies, one plant which had blossoms which were large nd which most important of all, were whiter than all e rest. These blossoms were growing among thousands a long hedge of hybrid daisies, but they stood out mong the thousands of white blossoms as strongly as they were a coal black

He wondered if other people could see that this one lant s blossoms were so much whiter than the others, o he led his workmen and all his visitors one at a time, ast the place where they were. But none of them could e one blossom that looked whiter than the others.

"If a flower is white," said one man, "you can t make any whiter The blossoms are all white, so far as I can e. They are all beautiful. You are a wonderful man, Ir Burbank. You have created lovely flowers. I think ou ought to introduce every one of them. Let the world enefit from what you have here. There is nowhere else hat anyone could see flowers lik these"

But when a woman artist from San Francisco was isiting his garden, and he led her to the hedge of large ew hybrid daisies and asked her if she saw one plant ith blossoms whiter than all the rest, she pointed to the lant which Mr Burbank had seen for so many days.

Yes, she said, "they are outstandingly different from ll the other blossoms."

The artist had a sense of color values which corresponded to Mr Burbank's sense. She could see what other visitors had not seen This delighted him and he felt that he was ready to introduce the new plant.

On two or three occasions, he had visited the vicinity of Mt Shasta in northern California. Mt. Shasta is a most beautiful mountain, perpetually covered with snow

"I'll name the new daisy in honor of beautiful Mt. Shasta, he said to himself

So he introduced the new flower as the *Shasta* daisy Thriving in all parts of the United States it is today the pride of many a flower gardener The huge graceful plants are prolific bearers of pure white blossoms Many blossoms grow to be as large as four or five inches in diameter indeed some have been found that measured seven inches across. Their roots multiply and the plants can be easily divided so that, in a short time a great quantity of *Shasta* daisies may be obtained by division of the roots of the original plant.

When Mr Burbank sold this *Shasta* daisy to a nursery man for introduction just as he did his other creations he didn t get an unusually large sum. But he had never forgotten what Mr Brown the banker told him on the day when they were returning from Marblehead after he had sold his *Burbank* potato for $150 Mr Brown had talked of growing new plants to serve mankind and Luther Burbank always sincerely worked for the benefit of mankind rather than for dollars and cents. It may well be that the *Shasta* daisy brought him more satisfaction than any other plant he created because it gave pleasure to so many people

By starting with a variety of rhubarb which he ...ured from New Zealand and which was almost worthless ...re, Mr Burbank was able to produce a new kind of plant which was later grown in the gardens of the King ...Italy the King of England and the Emperor of Japan. ...is small wonder that it appealed to these royal person... because it was so much large, so much more beautiful ...color and so much more delicious than any rhubarb ...own that no one who saw it was able to resist it.

It was introduced with the name *Crimson Winter* ...hubarb. The Crimson was suggested by the red ...lks the name Winter was inserted because this ...range new plant continued to produce large stalks in ...undance through the winter in mild climates.

When this rhubarb grew in New Zealand as an almost ...less variety with a stalk no bigger around than a lead ...ncil it produced its crop during December and Janu...y which are summer months in the southern hemi...here. Even though the seasons are reversed in Cali...rnia, it continued to produce during December and ...nuary Also the California spring stimulated its growth, ...d crops were harvested both summer and winter

The New Zealand plant was crossed with some of the ...tter varieties of rhubarb which Mr Burbank had and, ...ter working his customary magic with thousands of ...edlings, he finally selected the largest and best and ...troduced it as the *Crimson Winter* Rhubarb This new ...riety was so prolific and it brought such good prices ...ring November December and January when shipped ... eastern markets that many growers in California ...nped as much as $1200 a year per acre by shipping it.

The *Crimson Winter* Rhubarb can be easily prop...ted, for the roots multiply very fast and, when they

out into small portions, each portion will reproduce a new plant. Some stalks grow to be an inch or an inch and a half in diameter and four feet long, including the leaves.

This variety cannot be grown in the East because it cannot withstand the severe winter But it can be grown in a large part of California and inasmuch as it has the necessary shipping quality it can be sold in the eastern markets.

The Emperor of Japan and the King of Italy received roots direct from Mr Burbank These were planted in the royal gardens and they multiplied so fast there that there was not only enough to supply the royal families but much more

Robert Holmes a member of the Royal Horticultural Society in London, secured some of it to use in his own gardens and presented roots to the King of England and it was grown in the royal gardens for his use

Some of th new variety was sent back to New Zealand, its original home, and proved to be adapted to the climat It also was the first rhubarb which could be successfully grown on the Cape of Good Hope at the southern tip of Africa Thus it gained distribution in mild climates throughout the world.

The original supply of New Zealand rhubarb was secured through D Hay & Son of Auckland New Zealand The first two shipments were lost because the plants would not live during the long journey However the third shipment arrived safely in California and in it were about half a dozen of the small roots of this almost worthless food plant.

Mr Burbank first grew these without crossing and increased their number to about one hundred They produced seed in great quantities every year and this seed was planted and the seedlings carefully studied Crosses were then made with other kinds of rhubarb and astonishing indeed were the results

A bed in which some of these seedlings were growing ppeared rather ragged, because some of the plants were ery small and some were very large. However he wanted omething unusual he had to have a wide variety from hich to select.

After the *Crimson Winter* variety was well distributed, e kept on making other hybrids and eventually had two ore to introduce, one known as the *Burbank giant* and he other known as the *New Giant Crimson Winter* hubarb Both were of large size and were very vigorous roducers.

They both furnished crops the year around in Caliornia. However the quality of the stalks was so good hat, if they had produced only during the summer seaon, they still would have been worthy varieties. The talks are never tough or stringy and they have a pleasant aste when made into sauce or pies. The crimson colo emains after the rhubarb is cooked and that, of course, dds to its palatability When the roots are divided, a arge thrifty new plant has stalks ready to be harvested vithin twelve months.

Mr Burbank continued to work with the rhubarb hopng to get a hardy variety that could be grown in the orthern sections. Even a hardy variety would not produce winter and summer but he hoped to get ne that vould have the other desirable qualities of the new kind. uch a variety was not produced, but the rhubarb ex eriments afforded a good illustration of the world-wide cope of Mr Burbank's activities in finding strange plants or crossing and then sending new varieties to every ontinent. Although he remained in Santa Rosa, his arden had plant guests from every country and his plant iscoveries traveled around the globe.

It should be emphasized that one of the chief reasons vhy Mr. Burbank was abl to get so many unexpected and

brought together plants from widely separated parts of the earth.

He continually received shipments of seeds, bulbs, and plants from all parts of the world. It is certain that there never were ten acres anywhere in the world on which grew so many different kinds of plants, or so many new plants resulting from the crossing of pollen, as grew at Santa Rosa and Sebastopol. Never did the plant improver have a visitor following the year 1888 who could recognize all of the plants growing on his grounds. There were usually more than a million plants growing on the ten acres. Some of these were very small; some of them occupied many square feet of ground. But he had the knack of making use of every inch of soil and the minute a plant had served its usefulness it was taken out and the ground used for something else.

It might be correctly said, therefore, that the few acres at Sebastopol and Santa Rosa made up a *world* laboratory for plant improvement.

HARDY BERRIES COME FROM SIBERIA

When Mr. Burbank started work with raspberries and blackberries in 1878, he had hardiness in mind as well as improved fruits. He decided to get some wild raspberries from the coldest place in the world—Siberia. These he believed, would help make new bush fruits which would grow in any cold climate.

The plants from the far North produced berries which were worth almost nothing, it is true. The fruit was about the size of a pea, was a dark red color, and had large seeds. Furthermore the flavor was not pleasing, but the plant could withstand cold winters.

Mr. Burbank liked the sturdiness of the stems and the large size of the leaves. He felt that these were needed characters which would be transmitted to hybrids, and he knew that some new varieties might appear if enough seedlings were grown.

He crossed the Siberian berries with the California dewberry which is a wild and hardy trailing blackberry found in the foothills of the state. The berries are usually produced in large numbers, they are black, of good size and have a good flavor They have not become popular as cultivated varieties, because of the fact that the staminate flowers grow on one bush and the pistillate flowers grow on another For this reason part of the bushes in a garden do not bear fruit for staminate flowers produce only pollen, and all the berries grow on the bushes which bear pistillate flowers.

One variety of the California dewberry called Aughinbaugh, had been cultivated to some extent and it was this one which Mr Burbank selected for crossing with the wild Siberian plant.

He had no difficulty in making the combination of these wild strangers, for blackberries, raspberries, and dewberries can be crossed indiscriminately He xpected to get from this hybridization plants which would be of the widest diversity of character and his xpectations were realized. Nearly all of the hybrids were worthless. Some of them did not have vitality enough to live. Some bore small berries occasionally having only two or three seeds in each fruit.

There were a few however—three or four—which grew with great vigor One of these had fruit larger than either of its parents. The fruit looked somewhat like a blackberry in form but was a dark red in color When it was fully matured it came away from the core as the raspberry does when picked. It was a hybrid with almost a perfect blend of the two wild parents, but much better than either Named the *Primus berry* it was really a raspberry

The *Primus* was a good berry for home use, but was not good enough for commercial growing.

This was not the first raspberry which Mr B introduced. In 1893 he had sent forth a

which was called *Eureka*. It was larger than other raspberries, was a bright red color had firm fruits, and was very productive. The bushes incidentally were almost free from thorns yet as there were a few Mr Burbank did not call it a thornless raspberry

Seedlings from the *Eureka* were grown and one was introduced under the name *Dictator* This one was remarkable for its habit of yielding berries of enormous size. The berries were too soft for shipping, however so the *Dictator* was introduced for home use only A little later another raspberry was introduced under the name *Sugar* It bore its fruits in October as the *Dictator* did.

This was quite an array of remarkable berries
The *Primus*—raspberry not afraid of the cold
The *Eureka*—raspberry without irritating thorns.
The *Dictator*—raspberry of enormous size.
The *Sugar*—raspberry for late fall use

One year Mr Burbank traveled in Alberta, Canada, with the purpose of studying the natural hybrids of wild berries. He found many of them and concluded that ature is continually making new species of berries by ossing the pollen. He made similar observations among rawberries blueberries, and California lilacs.

This encouraged him to cross the dewberry with many arieties of raspberries and blackberries. Among the hybrids thus produced there was one even more remark able than the *Primus* berry Originally named the *Humboldt* it was later named by the seedsman to whom it was sold, *Phenomenal berry*

This berry phenomenon resulted from experiments in which both the red and yellow raspberries were combined with the dewberry The first generation of hybrids yielded nothing of importance, as usual. In the second generation however was one plant which was better than any Mr Burbank had ever seen. Some of the berries were an inch and a half long and an inch in diameter

hey were a dark, rich crimson color and they combined he qualities of the raspberry and blackberry in flavor Here, again, was a blend of the characteristics of the wo parents.

The *Phenomenal* berry is somewhat similar to a fruit alled the *Loganberry* which was a natural hybrid created y Nature and discovered by Judge J. H. Logan of Santa Cruz, California. The *Phenomenal* berry however is arger of better quality and color and more productive han the Loganberry

In ten years after its introduction, the *Phenomenal* berry was a popular variety among the growers of the Pacific Coast. It proved to be a commercial variety for t could be shipped to distant markets.

Other bush fruits introduced by Mr Burbank are *The Great American raspberry* the *Himalaya berry* the *Iceberg* blackberry and the *Japanese Golden Mayberry*

The bush fruits proved to be good material for the plant laboratory and, as their names indicate, they were cosmopolitans representing strains from many lands.

Luther Burbank experience with all kinds f plants showed him that foreign kinds are very useful in hybridizing experiments because they bring characteristics which have been developed under conditions quite different from those in America Furthermore when plants of widely separated sections are crossed there is always great variation, with many surprises, in the ffspring. As parent stock those plants from the far corners of the earth were more useful in bringing about new and useful char acters than locally grown plants.

So he welcomed plant immigrants of European Asiatic and African origin he worked with plums from France peaches from China, gladioli from South Africa. His *Shasta* daisies had an ancestry part New England part English part German and part Japanese, his dahlias came from Mexico and to help in his work with roses, he obtained some very interesting varieties from Chile. T

importing of plants from foreign countries so fascinated him that he enjoyed growing them regardless of whether he made use of them or not. Even today there are a number of strange plants growing on his grounds which are not likely to be found anywhere else in the United States.

From 1885 on he continued to arrange with those going to foreign countries to send him what he wanted. He could thus devote all of his time to work, and not consume any of it in travel and exploration.

PLUMS COME FROM THREE CONTINENTS

At the time Luther Burbank began his work of seeking new kinds of plums, which was in 1885 America had very few good varieties We were depending quite largely upon the wild plums which grow here. But Mr Burbank believed that it would be very valuable to get plums from other countries and combine the characteristics which they might have with those f the plums growing in America.

He had read that a plum with red flesh was to be found in the Province of Satsuma in southern Japan Accordingly he arranged with Isaac Bunting an English bulb dealer who operated in Yokohama, Japan to collect a number of plum seedlings.

The first shipment of plum seedlings from Mr Bunting arrived in 1884 in very poor condition. Mr Burbank therefore urged Mr Bunting to send other seedlings and on December 20 1885 he received twelve plum trees from the Satsuma province which had been produced by Nature from the seeds of wild trees. Such trees are called "natural hybrids. No man had crossed the pollen to produce them they were Nature s own creations

Of course Mr Burbank did not know whether their fruits would be of any value or not. But if they were not he thought that they might serve as good parent stock to be used in crossing with plums from other countries He had larger plum trees growing on his Sebastopol farm and he grafted short pieces from the seedlings on the older

trees in order to get the fruit sooner And when he looked at the fruit of the twelve plum seedlings he was astonished because there were so many plums in this collection which appeared to be much better than those grown in the United States.

The first of these seedlings which proved good enough to be introduced bore fruit the year after it was grafted. The fruit was very large, heart-shaped red with white bloom, and very good in flavor Mr Burbank showed it to all of the people who visited his place during the next two or three years These visitors included men from the United States Department of Agriculture, and one of them, Professor H. E Van Deman urged Mr Burbank to introduce this new plum. With this encouragement, h introduced it in 1889 as the *Burbank* plum.

Large size and its attractive color and taste made it popular at once. In a few years, as many as 125 ca loads of the *Burbank* plum were shipped to eastern markets from California. This plum has proved to be of tremendous value in more places in the world than any other variety The tree is able to adapt itself to more different kinds of weather and soil conditions than others have been ble to do. It thrives through cold winters when the temperature goes as low as 30 degrees below zero It also survives the hotter conditions experienced in South Africa.

One of the other twelve seedlings first bore its fruit in 1887 It was a plum with red skin and dark *purplish red* flesh, and it averaged about two inches in diameter As the seedling came from the province of Satsuma, Japan Mr Burbank named it the *Satsuma*. It became popular in southern California and many of the eastern Gulf states, as well as in the southern hemisphere *However* it proved to be less adaptable to a wide variety of climates than the *Burbank* plum. It could not be grown very successfully for example, in the colder places.

While Mr Burbank introduced a few kinds of

which were useful only where they were grown his main effort was to provide horticulturists with varieties which could be shipped long distances. He believed that California was destined to produce fruit which could be shipped to New York successfully

So it was necessary to study market demands; to study shipping conditions to exhibit his fruit to growers, scientists, and government officials, and to learn in every way possible all that was necessary to know in order to judge the probable popularity and usefulness of the new varieties.

It would be almost truthful to say that it was Mr Burbank s work which started the commercial shipping of plums. Previously the plum had been quite largely a home fruit a family which had no plum trees usually went without plums. But Mr Burbank s work developed varieties which were such good shippers that hundreds of carloads were soon being carried entirely across this country making the three-thousand mile journey from west to east as successfully as he himself had once made it m east to west.

About three years after the introduction of several of large shipping plums a third of all the plums shipped m California were his new varieties At Santa Rosa and Sebastopol plum immigrants from three continents had been successfully Americanized and many of them were on the way to international success.

19. THE BEES AND THE HUMMINGBIRDS HELPED

Luther Burbank made use of the fertilizing habits of both the bees and hummingbirds. In his gladioli experiments, he planted the two parents to be crossed in adjoining rows, knowing that the bees and hummingbirds would be likely to go from one row to the other and thus carry the pollen in the way he desired it.

The hummingbirds were particularly fond of the gladioli, and did a great deal of the pollinizing for him. It made very little difference which blossom furnished the pollen because after all, Mr Burbank was not trying to disclose Nature s rules he was trying to produce new flowers. And by making use of the hummingbirds and the bees, he produced new flowers much more rapidly

In the production of the world s earliest cherry Luther Burbank again enlisted the aid of the bees in carrying the pollen. If he had undertaken to carry the pollen from one parent herry tree to another he would have had to content himself with only a few seeds each year But by getting the bees to do the work for him, he was able to get thousands of seeds from one tree which represented a cross between that tree and another selected variety

In order to get the bees to cross-pollinize two varieties he broke off branches from one tree, after it was in full bloom, and placed them upon the branches of the other When bees are working on one kind of flower they do not visit other types. When they are taking the nectar of the cherry blossoms, they visit no other fruit tree Consequently he was sure that the bees would take the pollen from the broken branch and place it on the pistils of the flowers in the tree on which the branch was placed. In this way he got the bees to make the cross and [illegible] always do a thorough job.

The parent cherries used in these crosses were popularly known as the Early Purple Guigne and the Black Tartarian. As time went on Mr Burbank secured cherries from Russia, from France, and from the eastern United States. Pollen from the foreign varieties was transferred to the hybrids and eventually several entirely new cherries were produced which were better than any of the parents. Several of them bore their fruits very much earlier but the early ones were inferior in other respects and early bearing alone was not enough to justify the selection of the new individual

However these early bearing kinds were used as parents for further crossing and eventually with the aid of the bees he developed the *Burbank* cherry It ripened several weeks earlier than any other fruit It was large in size attra tive in color savory in flavor And best of all it withstood shipment across the continent. The trees were hardy had abundant foliage to protect the fruit from the sun and it was a prolific bearer

Before introduci g the *Burbank* cherry to the general ublic in 1911 Mr Burbank sent sample shipments to eastern states In 1908 a ten-pound box sold at public tion for $15·00 Later on an entire carload was sold $7 50 per ten-pound box In 1909 a ten-pound box as sold in Philadelphia for $31 or $3 10 a pound !

In his 1911 catalog entitled "Twentieth Century Fruits, Mr Burbank described the *Burbank* cherry as follows

"The earliest of all large cherries, the largest of all early cherries and not nly the best of all early cherries, but unsurpassed by any cherry of any season. The trees are model in form vigor and never failing productiveness. The foliage, which is of unusual size, is so placed that the fruit is fully protected from birds and from crac king caused by late spring rains."

The *Black giant* and the *Honey Heart* cherries were introduced later and may now be purchased from nursery-

men but the *Burbank* was the one which brought more per pound than is paid for the most expensive candy

Why was the high price paid? In the first place there were only a few available In the second place the cherries came very early in the season. Thus, the dealer knew there would be no competition for several weeks. Furthermore, the cherries were so large and beautiful in color and had such a delicious flavor that he knew he would have no difficulty in finding retail buyers who would pay a high price. This emphasizes the importance of Mr Burbank's idea that an extra early cherry would have a better demand than others, and illustrates his grasp of market demands in a far-away city

As proof of the shipping ability he sent a box of the *Burbank* cherries to New York and had it shipped back to California. When it arrived after making the round trip the fruit was still in perfect condition. None of the cherries was too soft. None of them was damaged in any way

This careful attention to production all the way from pollen transfer to packaging shipment and sale of the fruit in distant markets, distinguished Mr Burbank's work from that of the botanist concerned only with tracing plant pedigrees.

Interested persons frequently ask "Who carried on Mr Burbank's work after his death ?" The answer is that, as yet, no one has attempted to carry on the work in which Mr Burbank was so successful and for several very good reasons.

In the first place, Mr Burbank was working on so many experiments at the time of his death that it would have been almost impossible for anyone to know what he had in mind in each case. When I asked him one day how many experiments he had under way he said, "I always have at least three thousand."

There was no other person at
knew all that he was striving

how to dig plant, rake and hoe but they had no idea whatever of the value of the plants with which they were working No one helped with his plant-pollenizing except the bees and hummingbirds. Sole responsibility for planning, selecting and making decisions was his.

There was no kind of labor on his place in which he did not himself engage He gave very few orders that were not accompanied by a demonstration of how to do the work and he could do a better job than any of his workmen. But he did not expect everyone to be just like he was, for he knew that other people have different experiences and different thoughts.

Some idea of his intense interest in his work and of his ability to handle men may be gained from two incidents

Among the millions of plants representing three thousand experiments at Santa Rosa, Mr Burbank once had a huge plant of Swiss hard. One morning he came into my office more excited than I had ever seen him

"Did you cut down that Swiss chard of mine ?" he demanded

Mr Burbank I would never cut a plant of any kind your garden I assured him. I have nev r picked a wer or fruit unless you told me to Certainly I did not cut down your Swiss chard.

"Well, he said somebody did Beaty I would rather h ve my right arm cut off than to lose one of the plants with whicl I am working That Swiss chard was the result of many years of work. But I know you didn t do it Forgive me for accusing you. It is such a loss that I just couldn't restrain myself

He nd I were walking through his greenhouse one day and there we saw a Mexican whose name was Joe Joe was pounding a bag full of seed pods The process he used for threshing the seed was to place the pods in a bag and then pound the bag with a stick

Joe was moving the stick very slowly and he wasn t

getting along with his job very fast. As we approached him Mr Burbank said, "Pound em like the devil Joe Pound em like the devil!

Joe moved faster When we got outside where Joe couldn t hear us, Mr Burbank said "That's the only language Joe understands."

Another difference between Mr Burbank and the orthodox researchers was his refusal to specialize. Some plant experts have specialized on apples, others on dahlias; but Mr Burbank never limited his interest to one field. He always worked with dozens of kinds of plants. No one else as yet, has had the broad viewpoint which enabled him to carry on many simultaneous projects while keeping all the essential details in mind.

It is not at all unlikely that someone sometime in the future may work on as broad a scale as Luther Burbank did. There is no reason at all why it should not be done, no reason why as good results should not be expected. Everyone else however up to now has worked on a much smaller scale

Although no one—scientist or layman—was able to arry on the work in which Mr Burbank excelled, it is leasing to realize that there are thousands throughout he world who have been influenced by his success and nade use of his published records. Perhaps if we added gether the plant creations of all of these people, we ould truthfully say that Mr Burbank's work is being rried on not by one individual, but by a large group of ture enthusiasts.

Certainly his experience has had a beneficial effect upon e world not only because of what he gave the world in w plant creations but because of what he taught others ho now believe that it is our destiny to help Nature prove the fruitfulness of this planet.

Even after he was a world-famous man, Luther Bur-

the children of a near-by school on his birthday "You go in my place he urged me 'I just can t think what to say But you tell the boys and girls I love them. Tell them that I know they will grow into good men and women. Tell them this is a beautiful world full of wonders. Tell them to look for interesting things and they'll never have a dull moment in their lives. Tell them to learn how to use what they find Tell them to have confidence and faith Who knows—one of them may do all that I have done, and more

SOME OF LUTHER BURBANK'S MOST IMPORTANT PLANT CREATIONS

Apples
Goldridge
Winterstein
Artichoke
Santa Rosa
Asparagus
Quality
Berries
Balloon Berry
Dictator Raspberry
Eureka Raspberry
Great American Raspberry
Himalaya
Iceberg Blackberry
Japanese Golden May berry
New type Balloon Berry
Patagonia Strawberry
Phenomenal
Primus
Rubus Capensis
Sugar Raspberry
Sunberry or Wonderberry
Cacti
Actual
Arbiter
anana
Columbia
Competent
Eldorado
Elegant
Fresno
Gravity
Hemet
Market
Melrose
Model
Montere
Myers
Niagara
Opaline
Pyramid
Quillota
Robusta
Royal
Santa Rosa
Signal
Solano
Sonoma
Special
Sugar
Superb
Titania
Vertex
Zalisco
Cherry
Abundance
Corn
Rainbow
Flowers
Amaryllis
Martinique
"Multiplier"
Callas
Dwarf Ever blooming
Fragrance
Giant
"One Best
Snowflake
Canna
Burbank
Tarrytown
Dahlias
Burbank
David Burpee
Fragrant
Giant Yellow
Golden West
Lemon Yellow
Marigold
Mountain
Sebastopol
"Unique Salmon
Daisies, Shasta
Alaska

Flowers—(Continued)
Bijou
Cereus Pitajya
Chloo
Dicentra, "Modoc Pearl"
Eschscholzia
Crimson
Fireflame
Gladiolus
California
Cisco
Conquest
Dazzling
Elegance
Esthetic
Gigantic
Graceful
Harmonious
Igo
Mariposa
Mulatto
Mono
Opaline
Pinnacle
Pohono
Radio
Santa Rosa
Shasta
Signal
Symmetry
Yalo
Heuchera cristata Improved)
Improved Alstroemeria chilensis
Improved Chlidanthus fragrans
Black Giant
Burbank
Honey Heart
Celeste
Celestial Strain
Goldleaf
Improved Shirley
Shirley (Santa Rosa Strain)
Silver Lining
Evening Primrose
America
Roses
All Blossom
Burbank
Copper Climber
Coquite
Corona
Golden Sunset
Little Hermosa
Peachblow
Pet
Santa Rosa
Snowbit Climber
Verbenas
Elegance
Mayflower
Grape
Montecito
Grass
Lippia Repens, Dixie
New Dwarf Pampas
Ground Nut
Giant
Nectarine
Blood
Flaming Gold
Nuts
Be
Ca
We
J
Le
Na
Op
Fea
Te
Plum
Ab
A
Ap
Bal
Bar
Bea
Bur
Cha
Cha
Cho
Clir
Cor
Com
Del
Del
Dor
Dua
Ele
Epo
Fir
Fla
For
Gav
Gre
Glo
Gol
Gre
Hal

Plums—(Continued)
Larkspur (Burbank Hybrids)
Lily
Fragrans
Glow
Pentstemon (New Brilliant Crimson)
Poppies
Burbank
Monster
Nixie
October Purple
Othello
Pasha
Prize
Purple Flame
Red Ace
Rubio
Santa Rosa
Satsuma
Scarlet Flame (red-leafed decorative plum)
Shipper
Shiro
Sultan
Vesta
Vesuvius
Victory
Wickson

Plumcots
Apex Corona Orange
Corona
Orange
Purple

Hale Chestnut
McFarland Chestnut
Palatine Almond
Paradox Walnut
Royal Walnut
Santa Rosa Walnut

Peaches
Burbank giant
July Elberta
Rutland
Triumph

Potato
Burbank

Prunes
Conquest
Giant
Grand Prize Purple
Morganhill
Pearl
Splendor
Standard
Sugar

Quinces
Childs
Pineapple
Van Deman

Rhubarb
Crimson Winter
Giant Pink
Improved Giant Crimson Winter

Rose Flowering Peach Trees
Orchid
Santa Rosa

Hermosillo
Honeymoon
Juicy
June Blood
June Redskin
Madera
Mammoth Cardinal
M ynard
Miracle

Squashes
Begonia leaved
Patagonia

Tomato
Burbank Preserving

Vines
Clematis
Ostrich Plume
Sno wdrif
W erly
Ipomea, Imperial Carmen
Scyphanthus elegans
S. O. alba
Solanum
Gayanum
Giant White

Miscellaneous
Asclepias New Chilian
Chilian Tomatillo
Chilian W ter Cress
Chives, New Pink
Myrtle, New White Variegated
Phytolacca,

Flowers—(Continued)
Bijou
Cereus Pitajya
Chico
Dicentra, "Modoc Pearl"
Eschscholzia
Crimson
Fireflame
Gladiolus
California
Cleo
Conquest
Dazzling
Elegance
Esthetic
Gigantic
Graceful
Harmonious
Igo
Mariposa
Modesto
Mono
Opaline
Pinnacle
Pohono
Radio
Santa Rosa
Shasta
Signal
Symmetry
Yolo
Heuchera cristata Improved)
Improved Alstroemeria chilensis
Improved Childanthus fragrans
Black Giant
Burbank
Honey Heart
Celest
Celestial Strain
Goldleaf
Improved Shirley
Shirley (Santa Rosa Strain)
Silver Lining
Evening Primrose
America
Roses
All Blossoms
Burbank
Copper Climber
Coquito
Corona
Golden Sunset
Little Hermosa
Peachblow
Pet
Santa Rosa
Snowhit Climber
Verbenas
Elegance
Mayflower
Grape
Montecito
Grass
Lippia Repens Dixie
New Dwarf Pampas
Ground Nut
Giant
Nectarine
Blood
Flaming Gold
Nuts
Bowman
California
Westralia
July gold
Leader
N tional
Opulent
Pear
Test
Plums
Abundance
America
Apple
Ballena
Bartlett
Beauty
Burbank
Chabot
Chalco
Choice
Climax
Combination
Compass
Delaware
Delicious
Doris
Duarte
Elephant Heart
Epoch
First
Flaming Delicious
Formosa
G lota
Greenhix
Glow
Gold
Great Yellow
Hale

Flowers—(Continued)
Larkspur (Burbank Hybrids)
Lily
Fragrant
Glow
Pentstemon (New Brilliant Crimson)
Poppies
Burbank
Nemster
Kirke
October Purple
Othello
Pasha
Prize
Purple Flame
Red Ace
Rubio
Santa Rosa
Satsuma
Scarlet Flame (a red-leafed decorative plum)
Shipper
Shiro
Sultan
Vesta
Vesuvius
Victory
Wickson

Plumcots
Apex Corona Orange
Corona
Orange
Purple

Hale Chestnut
McFarland Chestnut
Paradox Almond
Paradox Walnut
Royal Walnut
Santa Rosa Walnut

Peach
Burbank giant
July Elberta
Rutland
Triumph

Pears
Burbank

Prunes
Conquest
Giant
Grand Prize Purple
Morganhill
Pearl
Splendor
Standard
Sugar

Quinces
Childs
Pineapple
Van Deman

Rhubarb
Crimson Winter
Giant Pink
Improved Giant Crimson Winter

Rose Flowering Peach Trees
Orchid
Santa Rosa

Hermosillo
Honeymoon
Juicy
June Blood
June Rubidia
Madera
Mammoth Cardinal
Maynard
Miracle

Squashes
Begonia-leaved
Patagonia

Tomato
Burbank Preserving

Flowers
Clematis
Ostrich Plume
Snowdrift
Waverly
Ipomoea Imperial Carmen
Scyphanthus elegans
S. C. alba
Solanums
Gayman
Giant White

Miscellaneous
Asclepias New Chilean
Chilean Tomatillo
Chilean Water Cress
Chives, New Pink
[illegible]

SOME OF THE PLANTS WITH WHICH MR. BURBANK WORKED

Abutilon
Acacia
Acanthus
Alfalfa
Alligator pear
Almond
Alstromeria
Amaryllis
Ampelopsis
Apple apricot
Artichoke
Asparagus
Aster

Balloon berry
Balsam fi
berry
-ry
an
l eet
Birch
Blackberry

Blue flag
Brodiaea
Buff lo berry
Buttercup
Butternut

Cactus
Calceolaria
Camellia
Canna
Carnation
Carrot
Cedar
Celery
Cereus
Champion flower
Chard
Cherry
Chestnut
Chives
Clematis
Clover cockscomb
Coreopsis
Corn
Cotton
Cress
Crinum
Cucumber
Currant
Cypress

Daffodil
Dahlia
Daisy
Dandelion
Devil claw

Eucalyptus
Everlasting flower

Feijoa
Fir
Flax
Forget-me not
Fuchsia

Garlic
Geranium
Gladiolus
Goldenrod
Goumi berry
Gourd
Grape
Grasses (many kind)
Guava

H wthorn
Hazeln t
Hemp

Hickory
Hops
Horse chestn t
Hydrangea

Iceplant
Iris

Calendula	Eggplant	Judas tree
Calla	Elaeagnus	Juneberry
Callistemon	Elder	Jut
Camassia	Elm	Ry
Kale	Palms	
	Pampas grass	
Larkspur	Pansy	Scilla
Laurel	Parrotbill flower	Scotch broom
Lemon	Parsnip	Sensitiv plant
Lettuce	Passion flower	Sisyrinchium
Lilac	Peach	Snow ball
Lily	Peanut	Snow-on-the-mountain
Lippia	Pear	Solanum
Live oak	Peas	Sorghum ane
Loquat	Pentstemon	Spanish broom
	Pepper	Squash
	Persimmon	Squaw berry
	Petunia	Starflower
Magnolia	Phenomenal berry	Strawberry
M ple	Pine	Sugarcane
Marigold	Pink	Sumac
Martynia	Pitcher plan	Sunberry
Mayberry	Plum	Sunflower
Medlar	Plumcot	Sweet pea
Milkweed	Pomegranate	Tecoma
Millet	Poppy	Thistle
Monkey puzzle tree	Potato	Tigridia
Morning glory	Primrose	Timothy
Mountain ash	Primus berry	Tomato
Mustard	Prune	Tritoma
Myrtle		Tulip
Nasturtium	Quince	
Nectarine		
Nutmeg		
ats	Radish	Verbena
live	Raspberry	Vetch
nion	Redwood tree	Violet
phiopogon	Rhubarb	Virginia creeper
range	Rice	Waln t
rchid	Rose	Watsonia
		Wheat

SOME IMPORTANT DATES IN LUTHER BURBANK'S CAREER

1874—Began work with black walnuts.

1875—Luther Burbank left Massachusetts f[or] California.

187[illegible]—First fruit trees sold from his Santa Rosa nursery

1877—Income from the sale of [n]ursery stock was $15.20.

1878—Began work with gooseberry blackberry rasp[berry] Juneberry strawberry currant

1878—Work started with raspberries and blackberries.

1878—Income from nursery $44

1879—Began work with prunes.

1879—Income from nursery $352 [illegible].

1880—Work for [a] thornless blackberry begun.

1880—Income from nursery $702.

1881—Produced [illegible]0,000 prune trees in one year

1881—Income from nursery $1 11[illegible]69

1883—Purchased four acres in Santa Rosa f[o]r his experime[ntal] garden.

1882—Experiments with the gladiolus began.

[illegible]—Chestnuts received from Japan.

[illegible]—[illegible]0 pounds of pear seed imported from Japan

[illegible]—Began work with pear quince peach, chestnut, loqu[at] persimmon.

1884—Made crosses of Oriental quinces on American varieties.

1885—Began lif[e] work of devoting all his tim[e] t[o] creating [new] plants.

1885—Began work with plums, grapes, verbena.

1886—Began work with [a]pples almonds.

1887—Began work [wi]th tomato.

1887—Satsuma plum fruit first seen.

1888—So many strange plant[s] grew in Burbank's garden that [n]o one scientist could recognize them [a]ll.

1889—Burbank plum introduced.
1890—Seeds of the Sand Pear imported from China.
1891—Wilder medal awarded for Burbank's Van Deman quince
1893—Eureka raspberry introduced.
1895—Crosses first made between peaches and nectarines.
1901—Gold medal awarded for the plumcot by the Pan-American Exposition, at Buffalo, N. Y.
1903—First stoneless plum sold to Oregon Nursery Co.
1904—Gold medal awarded to the Burbank Rose by the St. Louis International Exposition.
1905—Introduced the sunberry, the name of which was changed to wonderberry by the seedsman.
1905—Order to make a new variety of canning peas received.
1906—Burbank cherry tested for shipping ability
1909—Catalog issued offering 136 new varieties of Amaryllis
1909—Burbank's cherries sold for 31 cents per pound.
1910—Burbank's pineapple quince is the first quince to be shipped from California to New York.
1911—Thornless blackberry produced.
1911—Burbank introduced his first stoneless prune, the Conquest.
1911—Test pear introduced.
1911—Burbank cherry introduced
1912—New peas made to order were delivered to the Empson Canning Co.